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73 Magazine

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April 1967

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de W2NSD/1

never say die

CB

The CB licenses are now down to about 800,000 and the FCC reports that renewals are running about 12%. It would appear that the tide has turned and that the CB channels are changing from hobby use to business, as was originally intended by the FCC.

DXing

In answering the QSL's to my operations at FO8AS, VR2FD, FK8BG, 5W1AZ, 9N1MM and other exotica I have been surprised, to be polite about it, by the number of cards coming in with time and date in local terms instead of GMT. I'll be blunt: this is STUPID. I work four or five stations a minute and when I get a card in Mountain Standard Time I have to either make the conversion to GMT or else start looking through the logs until I find the contact. Perhaps one third of the cards have the time and date exactly right . . . and one third have the right date and the time within fifteen minutes (about 100 or so contacts to look through in the log). One third are way off with the date wrong and time either very wrong or else in local time. About 5% I just couldn't locate in the logs at all. Come *on* fellows, use correct GMT time and date.

ARRL

Perhaps my approach to the League has been a bit critical, but implicit in this was a constructive intent. I do believe that we should have an organization to represent the amateurs. Many amateurs firmly believe that this is the present function of the League. Unfortunately this is a delusion. The League certainly *could* assume this function and I think that it would be very advantageous to amateur radio if the members of the ARRL made every effort to achieve this end.

You see, right now amateur radio has absolutely no representative organization. We stand just about alone as a major user of the radio spectrum without any such official representation. The other vested interests see to it that they have a good loud voice in Washington and they are right in there putting on the pressure whenever anything comes up that could help or hurt their groups. They work with the government agencies, with the administration, and with Congress to make sure that everyone knows their side of things and that they get the best shake.

A few ARRL directors have for years been trying in every way they could to get the League to open a small office in Washington and set up a lobby for amateur radio. No adequate reason has ever been given for killing off these attempts. The directors I have talked with about it felt that the main reason was that the HQ top brass didn't want to take any chances on the seat of power leaving them . . . and they didn't want to leave the nice green fields of Connecticut for the concrete of Washington.

They are probably right. Once something is started in Washington it is bound to take over for that is where the action is . . . that is where things happen. I suspect that if our ARRL were centered in Washington and had the ear of the FCC, the administration, and Congress that ham radio would not be in the terrible fix it is today. One of our country's most valuable resources is amateur radio and our government and Congress should be constantly made aware of this.

Loyal ARRL members would do well to ask their directors to press for representa-

(*Continued on page* 110)

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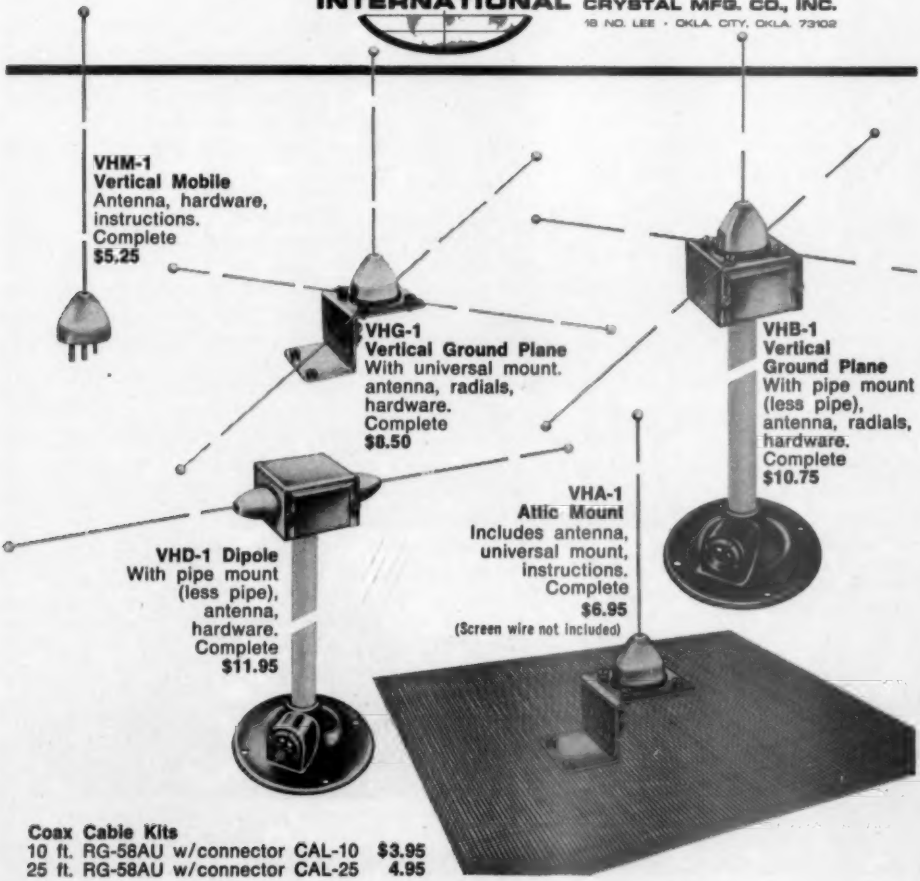

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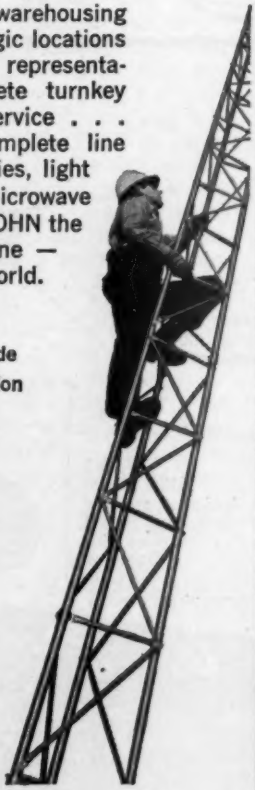

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Editors Ramblings

Editing a magazine is a peculiar occupation at best, and editing *this* magazine is probably even more peculiar than most. It often seems like a big, unreal game. However, even though the game is a hectic and nerve-wracking one at times, I must admit that I've enjoyed most of the last three years while I've been at 73, and particularly the last year or so while I've been editor. I've enjoyed meeting many interesting people—authors, readers and advertisers—and have learned much about electronics, publishing and ham radio. So it's with mixed feelings that I announce that this is the last issue of 73 that I will edit. I've tried to improve 73, but know there's far more that can be done. That's why I'm happy that the new editor will be Jim Fisk W1DTY, ex-WA6BSO, KR6JF, K4RPW, K3CPJ, and KA9MF. Jim is well known to all 73 readers for his many articles and books. He is a DX'er (SSB and CW) as well as an avid experimenter, home-constructor and UHF-VHF fan. Jim is highly competent and I know that 73 will improve steadily with him in charge.

As for me, I'm joining General Radio Company in Concord, Massachusetts, but hope to keep my hand in ham radio publishing by editing the new 73 column. "What's New for You?" and by writing. Until then.

73

Paul Franson WA1CCH

Jim Fisk W1DTY

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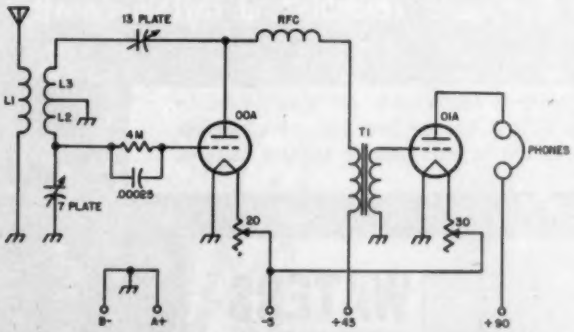
Al Freddy Newham WN1ECCH
Flagrant, New Hampshire

The Super Duper Super

When my ticket arrived from the FCC, I was really up against it—I had to have a good receiver. I was all set in the transmitter department; one of my good buddies from across town donated a slick crystal controlled job with a pair of 199's in the final. I couldn't come up with any home-brew receivers that matched the goodies I had in the junk box after searching through the current ham magazines, so I decided to use a little ingenuity and the parts that I had on hand.

I'll have to admit that this design is not completely my own; it evolved from several of the articles that I read before starting this project*. Here again my good buddy was a big help—he gave me a whole carload of ham literature. After drooling over the Marconi loose couplers, Grebe receivers and REL transmitter kits in the ads, I did a lot of reading about receivers. With the helpful hints of these articles under my belt, and a lot of sweat over the kitchen table, I came up with the two tube super duper super shown here. It may not be quite up to par with the Colland's Super Century or the Crutchcrafter's SD-150, but it runs a very close second. And besides, it didn't cost



METERS	L1	L2	L3
100-50	10	23	12
60-30	5	12	6
40-23	3	6	3

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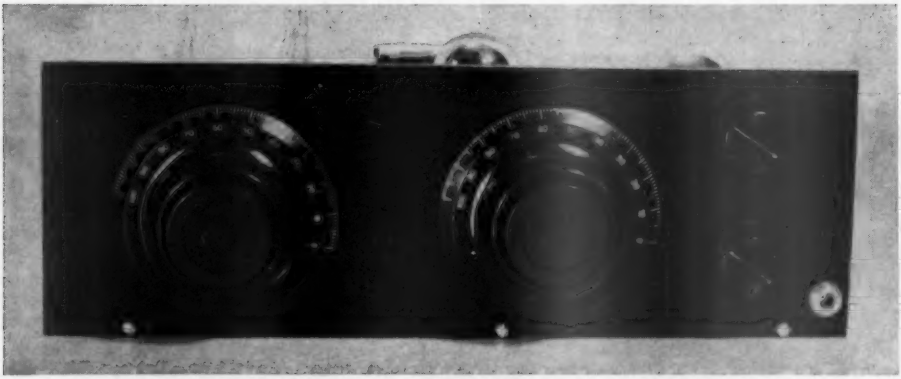
Fig. 1. Note the stark simplicity of the super duper super. Only two tubes, three condensers, three resistors, an amplifying transformer and some wire are required. For details on how to wind the coils and the rf choke, consult the text.



The super duper super. The large dial to the left is the rf tuning control; the large dial to the right controls regeneration. For best results these two knobs must be worked together. The two knobs on the far right control the amplification of the detector and audio stages.

1/10 as much.

The basic plan I had in mind was to come up with a receiver that was simple to build and use and that could be duplicated by other hams with a junk box like mine. I opined that there must be a lot of fellows in the same boat as me—lots of parts but no circuit that they'll fit. And then too, I didn't have a whole lot of goodies; in fact, at times I wondered if I would be able to come up with a workable receiver with the things that I had. As you can see from the schematic, this little job only uses two tubes, three condensers, three resistors, one transformer and some wire; you can't get much simpler than that!

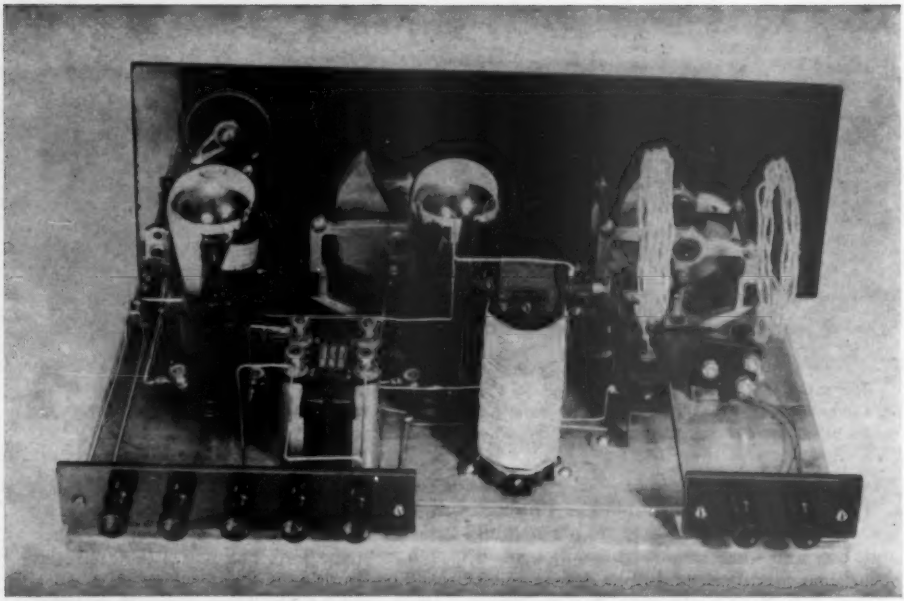
Basically the super duper super consists of a regenerative detector and an audio amplifier. I experimented with various methods of controlling the regeneration in the detector, but finally decided that the Weagent capacitive regeneration control gave the best results. The circuit seemed to be the easiest to tune and didn't move too far off frequency when I pulled my hand away from the dial.

I heard someone say once that much of a receving set's performance depends upon the correct choice of the grid leak and my experimenting bears this out. It must be quiet and must have a resistance of four or five megs for CW work. For phone work (after I get my general ticket), values as low as 1.5 megs seem to work quite well. The grid condenser was also determined by cut and try. I found that a grid condenser capacity of a micromicrofarad per meter is not too far wrong for the 00A detector. I didn't use this value however because all I had in the junk box was a 0.00025 unit.

The tuning condensers are just as they came out of the junk box. There are no markings on them so I don't know what their capacity is, but the rf condenser has 7 plates and the regeneration control has 13. Actually, almost anything will work here; all you'll have to do is change the number of turns in the coils.

And the coils—they are the most unique part of this whole design. After scanning the ads and the ill gotten gains of my broken piggy bank, I decided that I'd have to use air wound coils and forego the nicety of coil forms. From what I have heard since, this was probably a good decision; most of the bakelite and hard rubber forms are pretty lossy on the short waves. I managed to glom on to a couple of rolls of D.S.C. (double silk covered to the uninitiated) annunciator wire and decided to use that for the coils. By evenly spacing 13 large finishing nails around the perimeter of a 3 inch circle, I formed a jig for winding my basket-weave coils. By weaving the wire around the circle of nails, I ended up with a strong coil that was easy to handle. A raid on mother's sewing basket provided some heavy cotton thread to tie the turns together.

To cover the various wavelengths that I am interested in I had to have some method of plugging in different coils. A home made plug in coil arrangement was made by mounting banana plugs and jacks on a



The working parts of the super duper super. The antenna coil is on the far right with the rf and tickler coil to the left. The large upright object in the foreground is the Newham special rf choke. The two terminal strips on the back edge of the apple crate provide connections to the batteries and antenna. Note the geometric layout of the wiring which contributes so much to the set's performance.

couple of bakelite strips. At first I laid out the strips nice and even with the center tap right in the center of the jack bar, but this led to some quick shuffling when changing coils—you couldn't tell when the tickler was plugged into the right two holes. A modification moved the center tap a little off center so I didn't have to count turns every time I changed wavelengths.

The antenna coil was mounted on another chunk of bakelite which pivots on a brass angle support. With this arrangement I can vary the coupling between the antenna and rf coil for best results. This is a little ticklish until you get used to it because when you put your hand over the panel to move the antenna coil, everything changes frequency. However, with a little practice you can almost tell ahead of time which way the tuning is going to go.

The rf choke was a pure stroke of genius if I do say so myself. The first efforts resulted in a whole bunch of dead spots in the tuning range. That is, spots where the detector refuses to give out with nary a whistle. I don't quite understand all the ramifications of these dead spots, but I'm working on it. Anyway, the most suitable rf choke I found consisted of 205 turns of number 30 S.S.C. (single silk covered) lump wound on a home made form. Losses are apparently not too important in an rf choke so I made a form by screwing four four inch strips of bakelite to one inch squares of orange crate wood.

After building the complete receiver on the kitchen table, I had to come up with some more portable way of building the finished product. Mother didn't take too lightly to the screw holes and soldering iron burns in the table top, and besides, how was I going to get the table into my shack? The family had to have someplace to eat. Except for a little spilled soup in one of the condensers, the super duper super made it through this crucial period with flying colors. I can't say the same for its originator—for a while I thought ham radio would be banned forever from the Newham household.

A couple of raids on the city dump yielded the rest of the material I needed to build

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the super duper super into one compact table top package. The side of an old apple crate served as the bottom and a piece of bakelite from an old Army surplus aeroplane spark transmitter (Mark II) was used for the front panel. All the parts were carefully laid out on the apple crate and then wired together with solid number 16 bus wire. I took great care to make sure that all the wires were parallel to the sides of the apple crate and to make sharp 90 degree bends when turns were necessary. This layout works pretty well down to wavelengths of 23 meters, but below that performance is not so hot. My good buddy said something about lead length? I don't understand this at all because everyone knows that the shortest distance between two points is a straight line, and all my wires are perfectly straight. I am usually a pretty modest fellow, but the wiring job is magnificant in its geometric beauty, even if it doesn't work on the ultra highs below 20 meters.

The super duper super is a real dream to use. It only has four controls and *only* two of these have to be tuned at any one time. It only takes about eleventeen hours to get the proper technique down pat. Almost everyone who has had a chance to use the super duper super has been surprised at its performance. It doesn't surprise me at all, I knew it would work all along. After all, it is based on many proven designs. It has surprised some hams so much that they went away mumbling to themselves. Naturally all this pleases me very much because this was my very first ham project.

Now that I have been on the air several months with my twin 199's and super duper super, the junk box is starting to fill up again. I now have lots of tubes, amplifying transformers, condensers and even a couple of little doodads marked 2N384. My good buddy claims that these miniscule little gadgets will replace the tubes in the super duper super, but I don't hardly see how—they only have three connections. Anyway, I'm working on it and I'll have a full report for all you readers in a subsequent article.

. . . WN1ECCH

*"A One Control Neutrodyne," J. MaLaughlin, QST, August 1924.
"Short Wave, Plug-In-Coil, Receiver Design," F. Marco, QST, February 1926.
"Short Wave Receiving Sets," L. Hatry, QST, July 1926.
"A Simple 1750-and 3500 kc Receiver," B. Dudley, QST, November 1929.

Gene Klein W4BRS
6814 Criner Road, S.E.
Huntsville, Alabama

A Toroidal VFO

Gene has made an excellent VFO using a toroidal inductor. This VFO has many interesting construction ideas.

Many advantages can be gained by using toroids in amateur radio equipment. Their small size and high-Q head the list of reasons why they are seeing more and more applications today.

No longer is it necessary to use a four or six inch square box to house the big ceramic coil in the home-made VFO. No longer does the circuit stop oscillating when we attempt to reduce the box size, now that we have toroids. One of these ⅜-inch-diameter gems can be mounted right on a printed circuit board along with the transistors and capacitors which make up a VFO circuit.

A transistorized VFO employing a toroid coil was described by Jo Emmet Jennings W6EI in 1963.[1] Del Crowell, K6RIL sparked current enthusiasm with this recent excellent article[2] from which our circuit (and several cores) were borrowed. In this article is described a practical approach to the construction of a very compact and dependable VFO. The mechanical work required to fabricate the aluminum housing can be done with the simplest hand tools available in most ham workshops.

[1]The Transistor Radio Handbook—Editors & Engineers Ltd.

[2]A Stable VFO or VHF or HF—73 Magazine, November, 1966.

Circuit

A conventional Clapp oscillator is used, feeding an emitter-follower buffer stage (Fig. 1.) High frequency NPN transistors such as the 2N697 are used for the oscillator and buffer stages. Temperature compensation is provided by the 75 pF NPO type ceramic capacitor. The relative values of this capacitor and the 100 pF silver mica capacitor may be varied experimentally to provide flexibility in achieving optimum compensation.

An rf probe and vacuum tube voltmeter are indispensable when substituting transistors and making circuit adjustments for optimum output. Approximately 0.3 to 0.5 volts rf should be measured at the emitter of

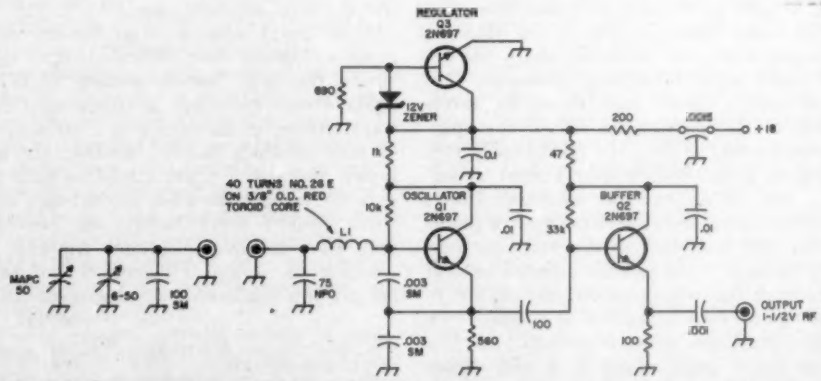
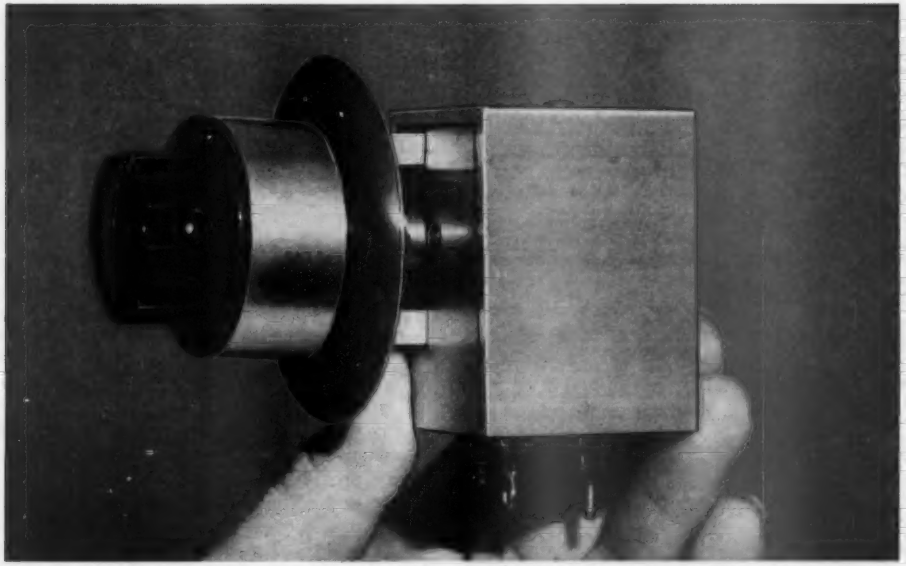


Fig. 1. Schematic of the VFO and power supply. Regulation is provided for both the oscillator and buffer. If more rf output is required, a tuned circuit (toroid, of course) can be installed in the emitter of Q2 in lieu of the 100 ohm resistor.



The completed VFO with dial ready for calibration. One screw holds the cover in place. Trimmer capacitor and feed-throughs are used to secure the VFO to a chassis.

Q1. Decreasing the 560 ohm emitter resistor will increase the output up to 1½ to 2 volts whereupon oscillation will stop. The oscillator Q1 should be operated at the lowest emitter current consistent with obtaining approximately 1½ volts output at the emitter for Q2.

The regulator transistor, Q3 is an audio type NPN in a shunt regulator configuration. In the author's circuit, a 2N697 rf transistor was used because it was available. The zener diode clamps the base-to-collector voltage of Q3 to the value selected for VFO operation; in this case 12 volts. This diode may be of the inexpensive ¼ to 1 watt variety. Power for the VFO was obtained from a 6.3 volt transformer and a conventional voltage doubler circuit which provides a peak voltage of about 18 volts.

This VFO configuration may be used at any frequency from 1 to 10 MHz by selecting proper values for L1 and its associated frequency determining capacitors. However, in the author's application, the frequency range of 3.5 to 3.65 MHz was required for doubling to the 40 and 20 meter bands.

Assembly

The various parts of the VFO are shown in the photos. Four #4-40 screws hold the component board in place. The piston-type trimmer capacitor to the right is a Cambridge Thermionic Corp. CS6-50. It is externally adjustable and is used for band setting as well as for securing the VFO housing to a chassis. Positive 18 volts enters via the feed-through capacitor. Centralab Type FT-1500, which aids in mounting the VFO, as does the rf bushing, USECO #1433, to the left in the photograph.

A frequency spread of 150 kHz is achieved with a Hammerlund Type MAPC-50 tuning capacitor. The type capacitor having a ¼ inch shaft extension should be used.

Component Board

A phenolic or glass-epoxy board, 1/16 inch thick is used to mount the components. Fig. 3 shows the position and identification of the parts. In the VFO illustrated, a prepunched phenolic board was employed. Transistor sockets are used to provide greater flexibility in experimenting with different transistors. No deterioration in frequency stability was experienced when using sockets for the oscillator stage due to the "swamping effect" of the large 3000 pF silver mica voltage dividing capacitors.

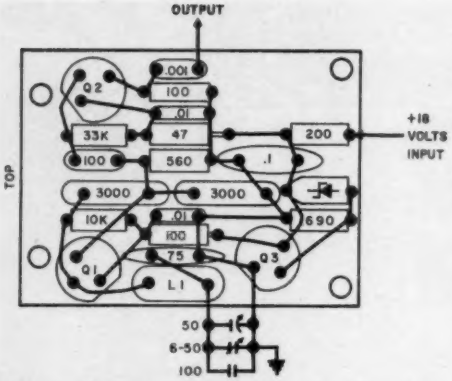
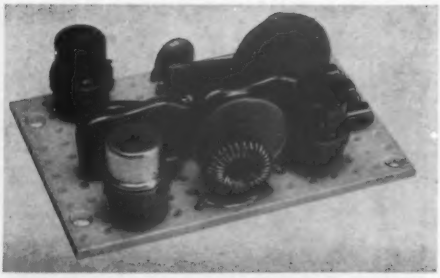


Fig. 2. Component identification is shown here. Because of the small size of the assembly, component leads may be simply bent over and used as indicated, instead of a printed circuit.



The VFO component board. Pre-punched phenolic material is convenient for the amateur constructor, however, a printed circuit board would improve appearances and provide a little more freedom in making the most desirable component spacing.

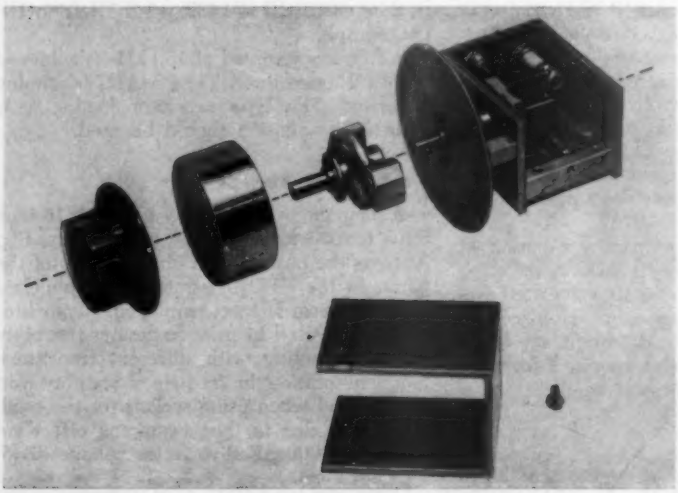
Housing

The objective of our VFO design was small size and simple mounting. For these reasons, a special housing had to be built because no commercial box or chassis was found suitable. The scrap pile of a local window glass shop provided rectangular aluminum tubing measuring 1-¾ inches by 4 inches outside. Two "U" shaped pieces were cut from the rectangular tubing so that they precisely "nest" together. One #4-40 machine screw holds the cover in place.

Brackets for mounting the component board were cut from aluminum scraps and glued in place using epoxy cement. While epoxy provides a valuable fabrication technique, one should not depend on cemented joints for electrical connections. The ground lead from the component board should be brought out and soldered directly to the tuning capacitor terminal as well as to a lug under the piston-type trimmer.

Tune Up

When using a toroid coil core it is impossible to use a grid dip meter in the conventional manner for verifying the frequency of a tuned circuit. This is because the flux of the coil is almost entirely contained within the closed core. Therefore, prior to ce-



Exploded view of the VFO and dial drive mechanism. Two Jackson Bros. planetary-vernier drives provide a 36:1 ratio. Leads to the tuning capacitor and feed-throughs are soldered after installing the component board.

menting the coil in place on the component board, it should be suspended by its leads which are left about 1½ inches long. These leads and the coil form a loop to which the grid-dipper may then be coupled.

After verifying the proper frequency of the tuned circuit, power should be applied with the regulator transistor Q3 only in place. Positive 12 volts dc will be measured at the collector of Q3. A check of the regulator under load can then be made by temporarily placing a 150 ohm resistor between the emitter and collector terminals of the buffer socket. This resistor, together with the 47 and 100 ohm resistors in the circuit, will present a total load of 300 ohms which will draw 40 milliamperes from the regulator, simulating about 100% overload conditions. The regulated 12 volts should show no discernable change under these conditions.

On the Air Tests

Excellent signal tone and stability are obtained from this VFO. The construction techniques used provide maximum immunity from mechanical shock and electrical transients. Long term stability is also achieved by negligible component heating and superior dissipation afforded by the sturdy housing.

A new era of VFO refinement is made possible by the toroid coil. The amateur constructor is well advised to include toroids in his present day projects.

. . . W4BRS

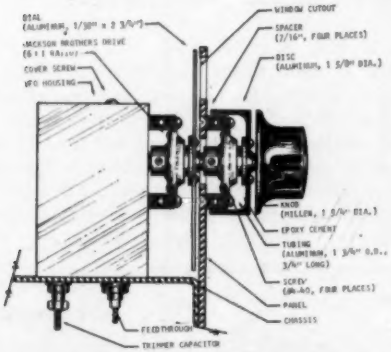


Fig. 3. Cross-section of dial drive mechanism. This arrangement is used in several commercial SSB transceivers. Spacers 7/16 inch long and taped for #4-40 screws hold the drives in place. The aluminum knob nearest the panel provides fast rotation (6:1 ratio) while the conventional knob provides slow speed (36:1 ratio).

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Transceiver CW Filter and Monitor

An inexpensive and simple transistorized accessory unit for improving the CW performance of any transceiver.

Just about every transceiver on the market still lacks adequate built-in provisions for CW work—that is, a CW keying monitor and sharper IF or audio selectivity for CW. The author previously built* a tube-type accessory unit that could be used with almost any transceiver to provide these functions. However, being an "outboard" unit it was not suited for use in mobile or portable applications. What was needed was a minaturized version which could be tucked away inside a transceiver case.

Circuit

After some experimentation, the author came up with the circuit shown in Fig. 1. Transistors Q1, Q2 and Q3 comprise a so-called "active" audio filter which allows a good deal of selectivity to be obtained by only RC circuitry. Essentially Q1, and the network in its base circuit make up a low-pass audio filter while Q3 with its network comprise a high-pass filter. The combination of the two circuits produces the selectivity characteristics shown in Fig. 2. The filter can be used between any two low-level, moderate to high impedance points in a receiver audio circuit.

The dashed line in Fig. 2 indicates the ideal if selectivity which a 2 kHz mechanical filter might provide. As can be seen the audio selectivity provided by the three stage "active" filter is a considerable improvement, at moderate attenuation levels, for CW work. If the graph were expanded to cover higher attenuations than 25 dB, it would be seen that the skirts of the active filter flare out beyond those of the mechanical filter. So, while the active filter will by no means pro-

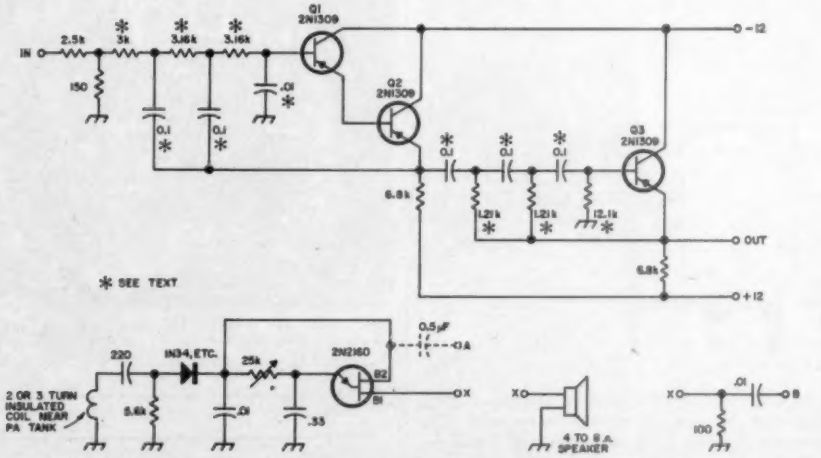

Fig. 1. Filter and monitor circuit which may be used with an SSB transceiver for excellent CW hamming. The −12 and +12 voltages may be obtained from any well-filtered point in the transceiver.

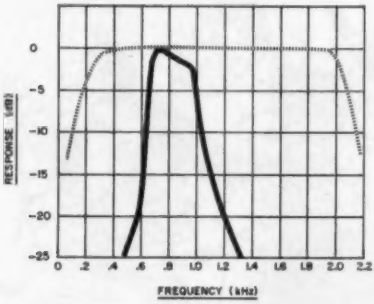

Fig. 2. Approximate frequency response of the filter shown in Fig. 1.

vide the same steep skirted selectivity of a narrow crystal lattice or mechanical filter, it does provide enough selectivity, in a very simple form, for effective CW work.

The CW monitor is rf actuated and uses a unijunction transistor in a relaxation type oscillator circuit. The 25 k potentiometer is used as a tone control. A 10 k fixed resistor could be substituted for further simplicity. Output for headphones can be taken from either points A or B. If the outputs from the filter and monitor are parallel to be used with a pair of headphones, some experimentation will be necessary with the coupling condensers at points A or B to find a value which gives sufficient output level without loading the filter unduly (depending on headphone impedance).

The tone from the monitor, like any relaxation oscillator, is hardly very easy on the ears but satisfactory for the occasional CW user. The CW monitor shown in **Fig. 3** is suggested if a smoother note is desired. The 12 volts necessary to power the circuit could be obtained from a RF pickup coil and rectifier, as with the unijunction type monitor, or from some point in the transmitter which provides 9 to 12 volts under key-down condition (across the cathode resistor of a rf stage in a grid-block keyed transmitter, for instance.)

Construction

Construction is simple and inexpensive. No adjustments, other than the tone control, are necessary.

How compactly the unit can be constructed depends solely upon the builder's ability to compact components on a perforated circuit board. Except, of course, for the rf pickup

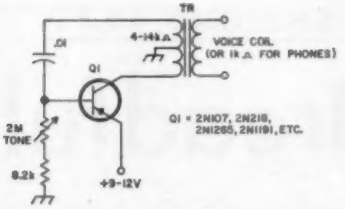

Fig. 3. Another tone oscillator which may be substituted for the one shown in Fig. 1.

coil which must be placed by the PA tank coil, the unit will fit on a 2" x 2" perforated board.

All the transistors used are of the $1 variety. The only components that are critical are the resistors and condensers starred in **Fig. 1.** If the selectivity characteristics of the filter are to be attained, the resistors must be of the 1% tolerance variety. The condensers must also be matched as closely as possible using, for example, a capacitance bridge or meter. If "off-the-shelf" 10% tolerance resistors and capacitors are used, performance will likely prove disappointing.

A great many, if not almost all, of the components necessary can be obtained by buying several of the computer boards available at three or four per dollar from various supply houses.

Usage

The unit can be wired into a transceiver so that it can be switched in and out of audio chain in the receiver. A still simpler, "no-holes" approach for those who only use headphones on CW and who have a medium or high impedance headphone jack on their transceiver is to replace the headphones jack with a multiple circuit unit, such as shown in **Fig. 4.** Plugging the headphones in the jack disables the loudspeaker and the filter and monitor are in the circuit ready for CW operation.

. . . W1DCG

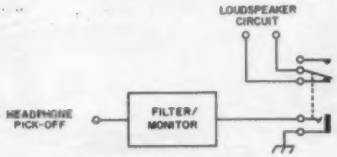

Fig. 4. A phone jack with additional switching circuit may be substituted for the regular phone jack.

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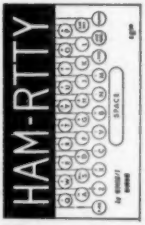

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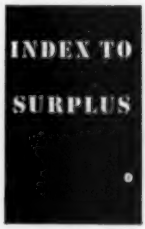

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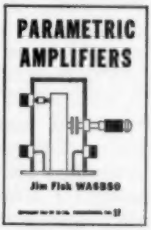

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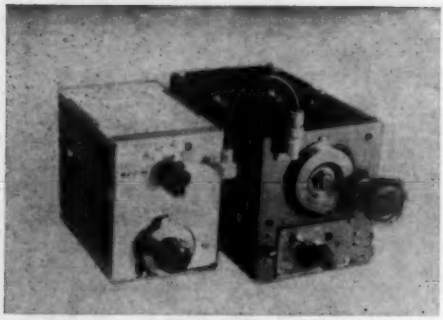


W1OOP's Converter Converter and modified BC command set.

The Converter Converter

Here's an intermediate converter for use between a UHF converter and a receiver tuning the broadcast band. It uses an inexpensive field effect transistor as a mixer for simplicity and excellent resistance to overloading.

A few weeks back I picked up the BC-band version of a command set at one of the local auctions. Now this is one of the nicer (and rarer) of the ARC-5 or 274-N series. It tunes 0.52 to 1.52 something or others (as this is about 23 years old, I guess they are megacycles) with divisions every ten kHz and about thirty turns of the knob to go the range. The intermediate frequency is 239 kHz and it has the same sort of variable-coupling cans that are used in the BC453, so sharpness is easily obtained.

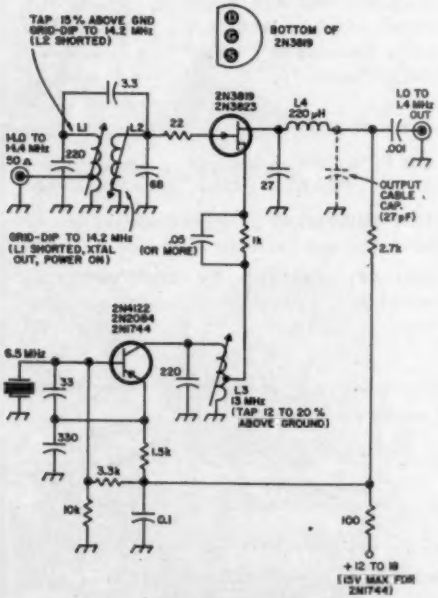


Fig. 1. Simple version of the Converter Converter by W1OOP. This is designed for covering 14.0-14.4 MHz, with 1.0-1.4 MHz output.

With such admirable selectivity and bandspread, it seemed a shame that it couldn't be used to run one or more of my UHF converters into, so as to have a permanent setup for scanning 431.95 to 432.4, for instance, while working or trying to work another band. While it is hard to get any image rejection with a second *if* of two or three hundred kilohertz, there should be no trouble in doing it with the receiver tuning 1 to 1.5 MHz. This converter was made for that purpose. My six, two and 432 converters have a nominal intermediate frequency of 14 MHz, while that for 220 tunes 16 MHz *down* for 220 *up*. By using crystals providing beating frequencies of 13 and 17 MHz the ARC-5 tunes forward on all bands, which simplifies the mental arithmetic a slew. (A slew is an archaic unit between three and ten dB.)

The oscillator uses surplus crystals at half frequency because I and Meshna had them. The mixer has an FET, since it made the whole business simpler. The 2N3819 (roughly the same as the TI-S34) can be thought of as a super-6CW4, or maybe a super-6CB6 with poor screening. It is quiet, it oscillates nicely at three hundred megohertz with only the leads to a twenty meter tank

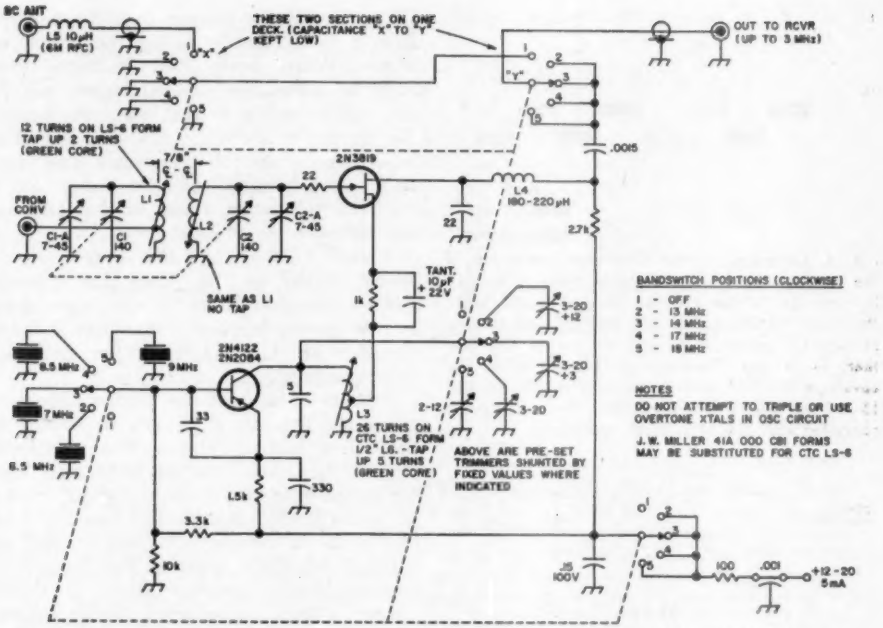


Fig. 2. More complete version of the Converter Converter, with band switching. Shield the quartz crystals if you live within 10 miles of a TV station.

circuit, and the gain, while less than overwhelming, is adequate. According to the manufacturers specifications, the currents and voltages could be almost anything, but that is no problem for the man who is making only *one* gadget, because the values can be tailored to the particular FET. Suppose we set up with a six to twelve volt battery on the drain (plate) and gate and source grounded to the negative terminal. We measure a current in the drain lead—it might be anything from 2 to 20 mA. For mixer operation, the FET should be turned all the way on only a bit of the time, and if we are trying to operate as a square-law mixer the gate voltage should swing from cutoff up to zero bias with oscillator drive, giving an average current about 40 percent of the zero-bias value, with drive, and a quiescent current 25 percent of the zero bias value. We can find the proper operating point by measuring the bias voltage required for one fourth the zero bias current, (no signal) and then setting things up so the source (cathode) resistor has that much voltage across it* when the oscillator is driving the mixer. My 2N3819 had 4.5 mA at zero bias. It also had UHF oscillations in the circuit, so I put that 22-ohm resistor in the gate lead . . . anything ten to fifty ohms would probably do.

With the second preselector tank shorted (I jammed a solder lug into C2) the current with oscillator going was 1.6 mA, but with

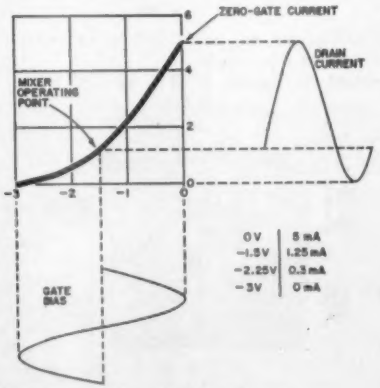


Fig. 3. Operation of the FET mixer.

*Measure through a good rf choke to avoid changing the amount of injection.

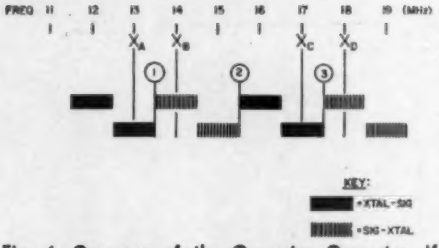


Fig. 4. Coverage of the Converter Converter. If the receiver tunes 0.50-1.50 MHz, there is no gap in coverage. If the receiver tunes 0.52-1.52 MHz, there is a 40 kHz gap at (1) and (3) and overlap at (2). Of course, if X_B and X_D are 40 kHz low, there is no gap. Coverage is 11.5-19.5 MHz. The coverage W1OOP wanted was 12-12.4, 14-14.4 and 16-15.5 MHz (the last backwards, for a 220 MHz converter with 236 MHz local oscillator.)

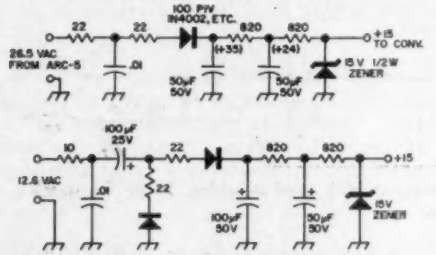


Fig. 5. Two suggested power supplies. The top one operates from 26.5 V ac from the command set and is the one W1OOP uses. The bottom one operates from 12.6 V ac and is hypothetical. In both, the 22-ohm resistors help eliminate hum modulation and hash as well as furnishing protection for the diodes.

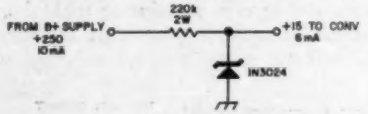
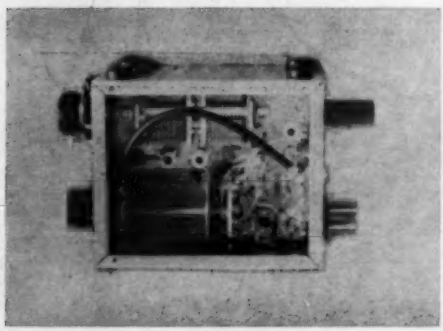


Fig. 6. You can get power for the converter from your receiver B+ supply.
Important: the resistor is 22 k, not 220 k!



C2 unshorted the current could be changed from 1 to 2.2 mA by tuning the preselector around. When working, the preselector tuned 1 MHz above the oscillator gave me 1.7 mA, while tuning to the low side dropped the current to about 1.4 mA. The big variations were when the preselector was tuned only a few hundred kilohertz either side of oscillator frequency. I judged that bias and injection were about right.

I used a 10-µF tantalum bypass on the source resistor, on the theory that it would reduce crossmodulation if any were going to take place, but any value over a 0.1µF should work. I had a lot of the small tantalums on hand.

Tuneup: The oscillator section should be got going first, as it is used in setting up the mixer bias as above. The preselector circuits then should be made to track over the range desired. If a dual 140-pF capacitor is used, the tuning range can be about two to one in frequency; for more range, use a larger capacitor. Many of the commercial ham-band-only receivers have a similar scheme. (They cannot track the preselector with the *if* tuning because sometimes they are going in different directions!) No *rf* stage is used because of the gain provided by the UHF converter ahead, but the two coils are loosely coupled by being side by side (0.875 in or 2.215 cm center to center) with windings in the same direction and the top end of each coil hot. (With this polarity, a little capacitance coupling will *add* to the inductive coupling.) The two circuits have to tune the right range (or a little bit more, but no less) and should do it together, but they don't have to track with a dial or an oscillator.

I started with the slugs all the way out and went to minimum capacitance on the gang capacitor. Then using the trimmers, I put both coils at about 20 mHz. A piece of drill rod in the coil *not* being grid-dipped keeps things simple. Dip one, shift drill rod, dip other. Then to low end (11.5 mHz) and maximum capacitance put slugs where they need to be. Then, using signals from an antenna or from the dipper, you can peak the trimmers on a signal at the high end and peak the iron slugs on a low end signal once or twice and the job is done. The preselector action should be very obvious. Write down a few dial readings so you can hit them again in a hurry.

The idea is pretty much the same as

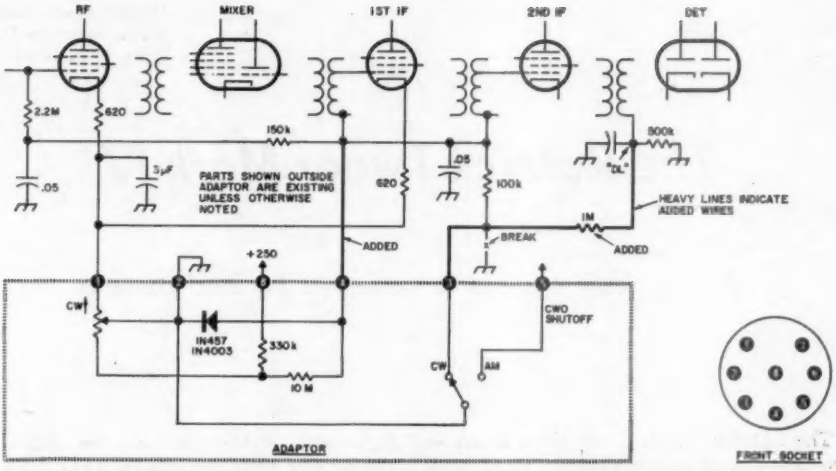


Fig. 7. Adding AGC and gain controls to the SCR-274N. The potentiometer is an Ohmite CB-2531, IRC-CTS Q14-120, Mallory U-28, RV4NAYSD253F or E. It has 25 kΩ total with about 2500 ohms to CW terminal at 50% rotation. The voltage on CCW terminal is low at low gain settings and about +15 volts with the control more than half on. This means no AGC developed until −2 volts on DL. Putting the switch in the CW position puts things back to the original 274-N status. You have to use some AGC delay or there's not enough audio. Replace the antenna connector with a BNC or phono jack for converter use.

K1Q1M's "Crystal-Controlled Front End" in the February 66 issue, except that we don't use tubes. One word of caution: although I put the crystals outside the box (in sockets) I found that there was pickup from my rather local TV stations, curable by putting a shield over them. Therefore, I suggest putting the crystals inside the box. The input is a two-stage bandpass filter, the output is a low-pass filter (cuts off a bit over 3 mHz) and there is not any excuse for hash from TV signals, nor for TVI from the oscillator, if things are laid out correctly, and the power leads filtered.

Because the power drain is only about 5 mA, the juice could be stolen from the B-supply in many cases. (Be sure the regulator diode used is dependable!) The power supplies shown will work on twelve or twenty-four-volt filament windings. Without readjustment, it should be ok to use with any receiver tuning either the broadcast band or up to 3 mHz, for instance the 1.5 to 3 mHz Arc-5.

Later tests show that the $1 Motorola MPF105 FET works very well in this circuit.

. . . W1OOP

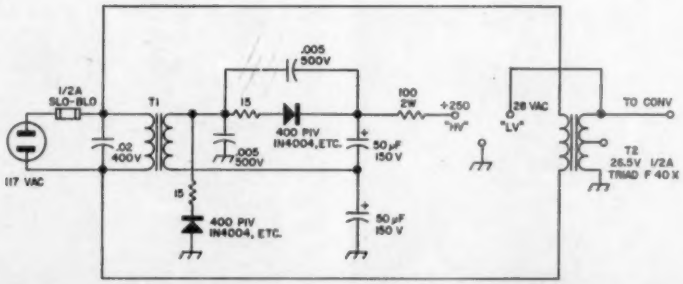


Fig. 8. Simple conversion power supply. T1 is a Lafayette isolation transformer XF or Triad N-51X (20 VA isolation transformer). Use the Triad backwards to keep B+ down. The 0.005 µF capacitors and 15 ohm (not critical) resistors reduce hash in the BC band.

Michael Bloom WA2RAT
3110 Kingsbridge Terrace
Bronx, N. Y. 10463

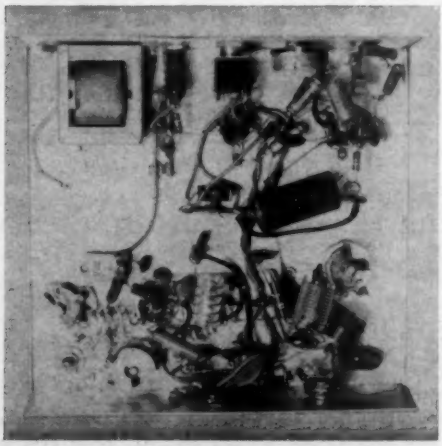
The Ratnick Twoer, Mark IV

A very simple two meter transmitter for local contacts

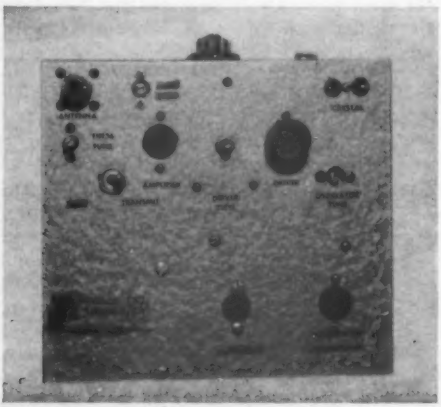
The Ratnick Twoer Mark IV is a simple two meter transmitter capable of a good signal with modulation percentage closely approaching 100%. As VHF transmitters go it is easy to duplicate. The circuit is straight forward and little trouble should be encountered as long as good VHF construction techniques are used. All rf carrying leads should be as short as humanly possible. The rule for bypassing is as follows: if you can't see the leads from the bypass capacitor you may consider it well bypassed. The lead arrangement of the audio section is not critical and any arrangement that appeals to the builder may be used.

The crystal oscillator is an electron-coupled type that oscillates on 8 MHz and has its output tuned to the third harmonic. It is very stable and may be driven by almost any high impedance VFO. The 24-MHz energy is tripled to 72 MHz in the second half of the 6U8. The final amplifier is a 5763 that doubles to 144 MHz. While this does not provide good efficiency it does simplify matters greatly in that the final does not have to be neutralized. The output is in the area of two watts and it is suggested that a high Q filter be employed in the output circuit to prevent the transfer of the spurious energy, i.e. TVI. Provision is made to key the final for CW though exceptional care should be taken to properly bypass the keyed cathode.

V3A and V3B are voltage amplifiers which are in turn fed into the 6AQ5 power amplifier. A neon indicator is used to show



Top view of the Ratnick two meter transmitter.



Bottom of the Ratnick two meter transmitter.

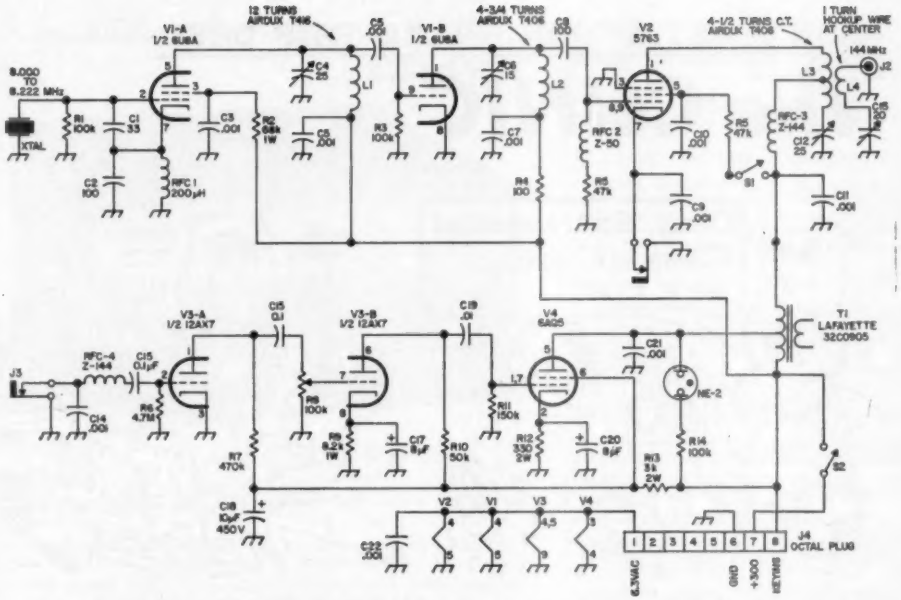


Fig. 1. Schematic of the Ratnick Twoer Mark IV. S2 is in parallel with an external relay connected to the "Keying" terminal.

the operator if he is modulating properly.

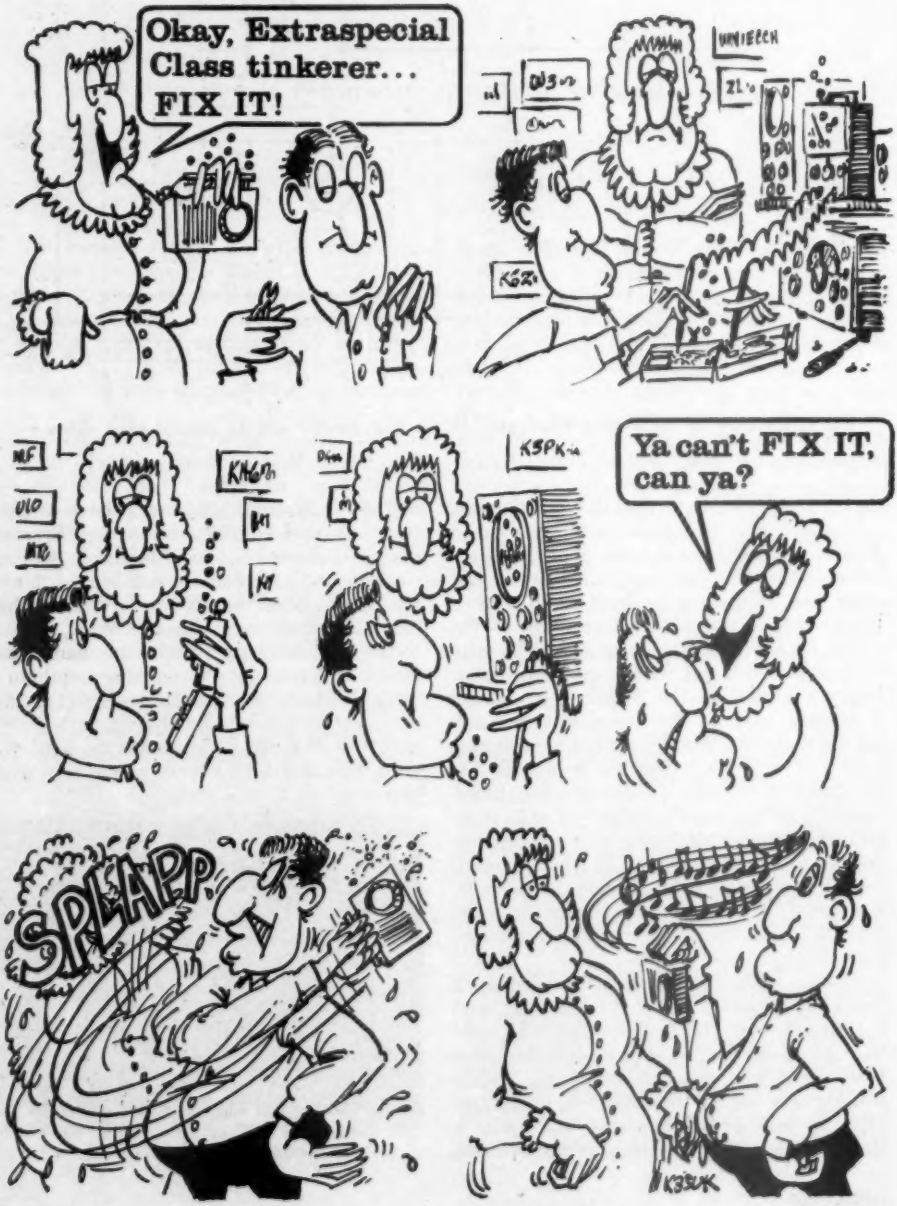
If the exact values given for the tuned circuits are used no trouble should be encountered at all. The tuned circuits will just cover the frequency range needed and it should not be possible to tune them to the wrong harmonic. However, it would be wise to double-check this with a grid dip meter. Insert a crystal in the socket and connect a dummy load to the transmitter through an SWR bridge. Simply tune for maximum output—it will be impossible to exceed the maximum plate dissipation of the tubes. Again double check the output of each stage with the dipper. Next plug in a microphone and slowly increase the audio gain control until the neon stays brightly lit as you talk. You will find that you have plenty of audio gain to spare. You are now ready to operate.

Results with this little peanut whistle (2 watts out) have been very gratifying and exciting. I have worked stations who said that when my signal approached the noise level the audio was still readable. While this rig is designed primarily for local ragchewing and nets it can give you quite a thrill DX'ing. With an eight element beam and a slight band opening I have worked New Hampshire, Massachusetts, Pennsylvania, Delaware, and Maryland without really trying and with crystal control. I also work the Windblowers in less time than many hundred watt boys. CW is also a thrill. One evening when the band was closed and no one was working anything I worked Chichester, N. H. with 5/1/9 signals. Not very strong but he was only 5/3/9 with his 400 watts. So, here's wishing you good luck and I'll see you on low power on two.

QSL cards from stations worked with the Ratnick transmitter and 829 linear from the Bronx.

DON MARTIN-WON'T-LIKE-THIS DEPT.

The CLINIC



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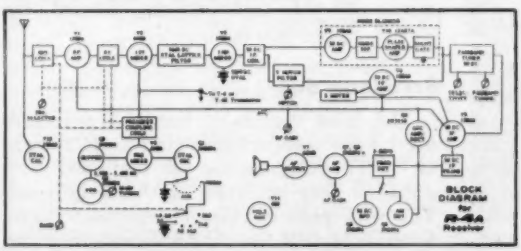
DRAKE

R-4A RECEIVER

Model R-4A **$399.95** AMATEUR NET

FEATURES

- **Solid State Linear permeability tuned VFO** — with 1 KC dial divisions.
- **Covers ham bands** 80, 40, 20, 15 meters completely and 28.5 to 29.0 Mc of 10 meters with crystals furnished.
- **Also covers 160 meters,** Mars, Citizens Band, WWV, Marine, and short wave broadcasts. (With accessory crystals.)
- **Or will give 5 Mc of continuous coverage** (with accessory crystals) for use with VHF converters.
- **Or tunes any ten 500 KC ranges** between 1.5 Mc and 30 Mc with accessory crystals; 5.0 to 6.0 Mc not recommended).
- **Four bandwidths** of selectivity (equivalent to 4 filters) are furnished: 0.4 KC, 1.2 KC, 2.4 KC and 4.8 KC.
- **Passband tuning**
- **Noise blanker** that works on CW, SSB, and AM; **Notch filter** and **100 KC crystal calibrator** are built in.
- **Crystal lattice filter 1st IF**
- **Premixed injection** — Crystal oscillator and low frequency VFO outputs premixed.
- **AVC with fast attack and slow release** for SSB or fast release for high speed break-in CW. Also AVC may be switched off.
- **Receives SSB, AM, CW, and RTTY** with full RF gain, complete AVC action and accurate S-meter indication.
- **Product detector** for SSB/CW—diode detector for AM.
- **Excellent overload and cross modulation characteristics;** insensitive to operation of nearby transmitters.
- **Compact size; rugged construction.**
- **Transceive capability;** May be used to transceive with the T-4 "Reciter" or T-4X Transmitter.
- **11 tubes, 7 transistors and 10 diodes**



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R. L. DRAKE COMPANY

MIAMISBURG, OHIO

SPECIFICATIONS — Model R-4A

FREQUENCY COVERAGE: 3.5-4.0 Mc, 7.0-7.5 Mc, 14.0-14.5, 21.0-21.5, and 28.5-29.0 Mc with crystals supplied. Ten accessory crystal sockets are provided for coverage of any 10 additional 500 KC ranges between 1.5 and 30 Mc with the exception of 5.0-6.0 Mc.

SELECTIVITY: Drake tunable passband filter provides:
.4 KC at 6 DB down and 2.6 KC at 60 DB down
1.2 KC at 6 DB down and 4.8 KC at 60 DB down
2.4 KC at 6 DB down and 8.2 KC at 60 DB down
4.8 KC at 6 DB down and 25 KC at 60 DB down
Selectivity switching is independent of detector and AVC switching.

I.F. FREQUENCIES: First I.F.—5645 KC crystal lattice filter; second I.F.—50 KC tunable L/C filter.

STABILITY: Less than 100 cycles after warm up. Less than 100 cycles for 10% line voltage change.

SENSITIVITY: Less than ½ uv for 10 DB signal plus noise to noise on all amateur bands.

MODES OF OPERATION: SSB, CW, AM, RTTY.

DIAL CALIBRATION: Main dial calibrated 0 to 500 KC and 500 to 1000 KC in 25 KC divisions. Vernier dial calibrated 0 to 25 KC in 1 KC divisions.

CALIBRATION ACCURACY: Better than 1 KC when calibrated at nearest 100 KC point.

AVC: Amplified delayed AVC having slow (.75 sec.) or fast (.025 sec.) discharge; less than 100 microsecond charge. AVC can also be switched off. 3 DB change in AF output with 60 DB change in RF input.

AUDIO OUTPUT: 1.4 watts max. and .5 watts at AVC threshold.

AUDIO OUTPUT IMPEDANCE: 4 Ohms and hi impedance for anti-vox.

ANTENNA INPUT: Nominal 52 Ohms.

SPURIOUS RESPONSES: Image rejection more than 60 DB. I.F. rejection more than 60 DB on ham ranges. Internal spurious responses in ham ranges less than the equivalent 1 uv signal on the antenna.

FRONT PANEL CONTROLS: Main tuning, AF gain, RF gain, AM-SSB/CW with slow AVC, fast AVC, or AVC off, function switch, band switch, xtal switch, passband tuning and selectivity, preselector, notch, and headphone jack.

SIDE AND REAR JACKS AND CONTROLS: S-meter zero, notch adjust, antenna jack, speaker jack, mute jack, anti-vox jack, accessory power socket, and fuse post.

POWER CONSUMPTION: 60 watts, 120/240 VAC, 50/60 cycles.

DIMENSIONS: 5½" high, 10¾" wide, cabinet depth 11⅝", overall length 12¼", weight 16 lbs.

Transceiving-mate DRAKE

T-4X XMTR

Use VFO of either R-4A or T-4X for transceiving or separately.

Amateur Net **$399.95**

Frequency coverage and VFO similar to R-4A • Upper or lower sideband on all bands • VOX or PTT • Adjustable pi network output • 2 special crystal lattice filters • Transmitting AGC • Semi break-in CW with sidetone • AM modulator • Adapt easily to RTTY • Xtal sockets available for extra bands.

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Cardboarding--

An integrated system to record, develop, test, index and file ideas.

Do not read this if you are in a hurry because:

It could change your attitude toward the creative phase of electronics.

Consistent application of several rules could change your way of life. The rules are valid whether your interest is vocational or advocational.

You will be induced into exploring the most obscure recesses of your mind.

The man that has not mastered his mind is the master of nothing.

If you do not have an hour to study now, put this aside until you are ready but, as a reminder write in the palm of your hand with a ball point pen the word–CARDBOARD.

Cardboarding is a hybrid system developed from several ideas related to breadboarding.

The genesis of breadboarding is not clear. The term has earned a permanent place in the language of electronics.

Breadboarding is used to denote mock-up, dummy set-up, cut and try engineering, or any trial layout of a temporary nature. I have seen the term used in a paper on chemistry. A physicist told ne that he had seen the term used in nuclear physics. This is understandable because the first cyclotron was a converted wireless arc transmitter from Palo Alto, California.

Early application of the term, breadboarding, was literal. Wireless components were fastened to a bread, or cutting board, to insure some physical stability and order. This method provided good access for alterations and maintenance. The flat layout on a single plane provided the designer with a bird's-eye view. A breadboard made it possible to establish a link between the abstract mental process and the concrete physical work. Oftentimes a breadboarded circuit became a permanent fixture. Large telegraph repeater stations would use huge mahogany or cherrywood tables, complemented by lacquered brass fittings, to mount the components for hundreds of telegraph channels. Some of these handsome components are conversation pieces in homes today.

I suspect breadboarding evolved from the old manual telegraph practice of mounting components on the operator's table top. As the station prospered, the tables were needed for other purposes. The components were rearranged on boards and fastened to the wall.

Various illustrations, of Alexander Graham Bell's development work on the telephone, have that breadboard look. Mr. Bell was trying to develop a multi-channel voice frequency telegraph system, nearly a century ago, when he observed a bit of phenomanae that led directly to the development of the telephone.

Mr. Bell jotted down spontaneous ideas and observations on scraps of paper, on the backs of household bills or in a small notebook. A scribbled notation related to "undulating currents" is credited with winning the patent rights to the telephone. The notation was on the back of a household bill! This incident serves to emphasize the cardinal rule of cardboarding; Record the idea or observation now.

Breadboarding

The most ingenious, fastest breadboarding I have seen utilized 'glass-knob' thumbtacks. The components are equipped with pigtails before mounting on the breadboard. The wire pigtails terminate in small loops. Several pigtails are thumbtacked together

on the breadboard to form a solderless tie point. Some of these boards look awful hairy but they are simple and easily constructed. The glass-knob thumbtack method is still practical for low frequency projects.

Commercial breadboard kits

To maintain a smooth stream of consciousness during the creative phase, breadboard designs were improved to permit the physical work keep pace with the mind. This important factor has produced a variety of systems. Several commercial kits furnish patch cords, plug-in components and special boards. The boards may be wood, plastic or metal. The more economical and simpler kits use perforated phenolic panels and special clip or spring connectors for a solderless tie point.

The makers of commercial boards emphasize saving time (speed), reusable components (economy), and structural visualization (spacial view). These systems do not integrate the schematic diagram to improve electrical visualization. Nor a means for recording, filing, indexing and duplicating the tests. The initial expense of the more elaborate kit is a disadvantage to economy minded experimenters. An elaborate kit, due to completeness, quality and flexibility is inherently costly. There are other features the experimeter may consider to be of greater importance. It is necessary to analyze the creative mind to illustrate that last statement.

The creative mind

All men are creative.

No race has a monopoly on invention.

All forms of mankind have contributed to the state of civilization that exists today. The ability to rationalize, to exercise logic and to project, are talents that distinguish mankind from animals. Another way of putting it; Man can prophesy. Current events seem to belie this, nevertheless, it is a fact. It is also true that mankind cannot predict every event in the future, however, the number of things mankind can predict exceeds the capacity to assimilate by any one man.

The creative talent varies among individuals. There are many factors that make up this talent. Some factors are inherited and others are the product of our environment. Most of these factors can be acquired by self study and self discipline. Here is a list of the predominant ones; Motivation, Education, Opportunity, Reinforcement, and Serendipity.

Motivation: Motivation can be generated by the desire to serve and is the noblest of mankind's endeavors. The will to survive, which is inherent in all normal men. Curiosity will stimulate a man into doing all sorts of curious things. There are others not so noble but powerful such as prestige, power, money and greed.

Education: The sum of all your knowledge composed of experience, environment, academic or self-trained at least in the area of interest.

Opportunity: Opportunity is related and proportional to your education. The broadest education possible is the best insurance that you will be exposed to opportunities.

Curiosity: Curiosity is considered an inherent trait. This valuable trait can be developed and parallels education. Curiosity can lead you to bold origonal concepts.

Reinforcement: This factor is a concrete form of encouragement. A series of minor successes or rewards will sustain a man for many years on a single project. For the competitive man success, based soley on 'being a winner', will suffice to make him expend enormous amounts of energy.

Photo 1. A cardinal rule is Record it NOW!

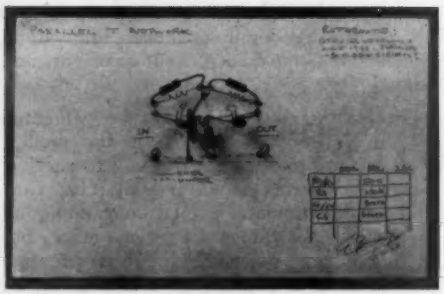


Photo 2. Groups of pinholes form tie points.

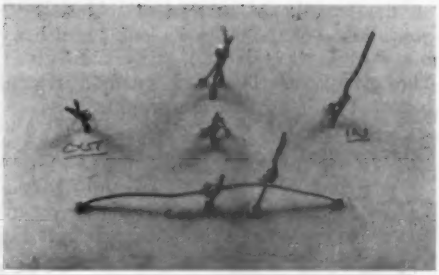


Photo 3. The pigtails are tacked together on the wiring side and lock the components to the cardboard.

Serendipity: This is probably the least discussed but one of the most valuable traits a man can acquire. An artist would define serendipity in this manner; Use whatever means and materials you possess to create a thing of beauty. A prosaic man would simply state; Improvise.

Ideaphoria: This an obsecure word rarely found in dictionaries. Ideaphoria is the rate or volume of creative ideas. The word is used in aptitude test results. A high ideaphoria indicates a highly creative imagination in the individual. In the context of this paper I am using the phrase 'creative mind' to connote high ideaphoria. The creative mind is a fulcrum upon whose sharp edge is balanced a man's sanity. Should his other talents be properly distributed he will be a prolific producer. He will be using all his talents and enjoying peace of mind. If the individual has not inherited or developed the other talents, he will become a paralyzed egomaniac who could destroy himself through utter frustration.

The preceding paragraph parallels my experience which led to the development of cardboarding.

The creative mind does not conveniently have single ideas.

The creative mind is boiling with ideas. It must improve everything it observes. Ideas pop out like olive pits. Most of these ideas are lost in the confusion and stress of the moment. The secret of capitalizing on the creative mind lies in some means for capturing these transients. These means must provide a favorable gestation period where the ideas can be selected or rejected in a stable environment. The resultant effect is to immobilize your ideas so that they may be examined and re-examined when the time and the attitude is right. The creative mind is capable of exploring many projects concurrently, with a little help. This discussion on the creative mind has led us, full circle, back to breadboarding.

In order to accent more desireable features that should be incorporated in the breadboarding process, a lengthy digression on the creative mind was presented. At least one of these features should be obvious. Perhaps it will help if this rhetorical question is asked: Can you imagine how much money an experimenter would have to invest in a breadboard system that could handle a half dozen projects simultaneously?

The cardboarding system includes this feature, with considerable economy.

The great ones

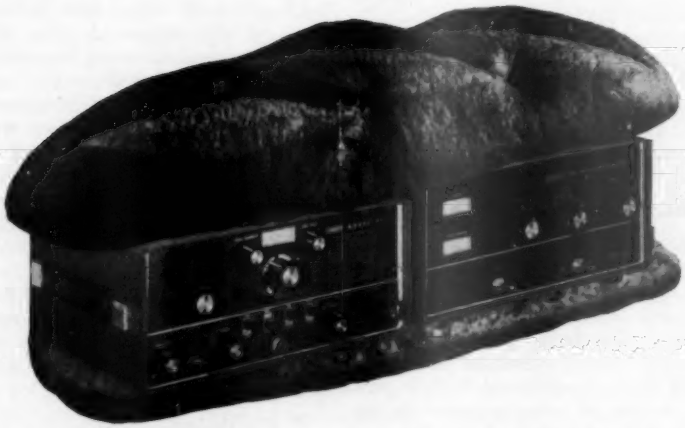
Men who have contributed much to our technology and comfort were not men with one track minds. Study the biography of any one of these men; Franklin, Jefferson, Whitney, Tesla, Bell, Edison, deForest, Armstrong, Steinmetz and Lawrence. The names are usually identified with one great contribution. This great contribution was the pinnacle of their endeavors. It is a rare pinnacle with a broad base. All these men had creative minds, not one idea in one field but prolific in many fields. The key to their genius reveals itself, not in a formal textbook presentation, but in scribbled notes, crude sketches on scraps of paper and little dog-eared notebooks.

It is true, conception is rarely neat.

These great minds, the orderly scientist, the prolific inventor and the great innovators, how could they generate a shining image of order and enlightment when all that

SBE

torpedo!
hero!
submarine!



The words may be different depending upon where you live but the meaning is identical—a delightful sandwich—lots of goodies tucked into a small space–and always, most for your money.

Add the words, "SBE COMBO" to the best-buy section of the menu whenever you want to sandwich a plump, four-band kilowatt into that small car and still have room for the family. (it's right at home also).

First combo layer—SB-34, 80-40-20-15 meter transceiver with built-in 12V DC and 117V AC supply and replete with such condiments as solid-state switching (no relays), USB or LSB (by panel switch), steep slope mechanical filter (Collins), delta receiver tuning (± transmit frequency). Varactor control dial set, 500 ma receiver-only standby drain (12V DC), 20 diodes, 23 transistors (only 3 tubes),one-knob dual speed tuning.

Second combo layer—SB2-LA, 1000 resounding watts p.e.p. input on 80-40-20, 750 watts on 15. And smallllll . . . only 5¼"H, 11¾"W, 11⅝"D, 43#. Built-in 117V AC supply uses silicon rectifiers and voltage multiplying to reduce transformer size/weight. Low voltage (800V) high current operation — easier on capacitors, diode rectifiers, components. Built-in antenna and control relays (2)—internal blocking bias—meters for plate current and output — uses 6 inexpensive 6JE6 parallel connected tubes.

Write for a menu—errr catalog.

SIDEBAND ENGINEERS—213 East Grand Avenue, South San Francisco, California 94080.

RAYTHEON

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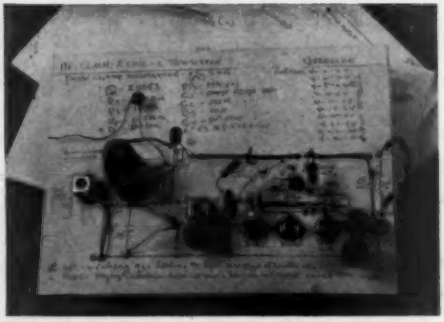

Photo 4. Jumpers interconnect the tie points either above or below.

can be found of the beginnings are scribbled notes and crude sketches? The answer to this question is the key to their genius.

Even though you scratch a word in the dust, it will be engraved forever in your memory.

Another way of putting it; It matters not the place nor time, nor why nor how. It does matter by rote or rhyme, record it now.

The cardboarding system

The cardboard feature of this system was one of many ideas recorded over a decade. The cardboard idea became the catalyst that bound several related ideas together to form an integrated system.

Cardboarding begins when you record the idea. **(Photo 1)** The cardboard feature parallels the stream of consciousness during the development and testing phase. The system provides a record of progress and summaries. A method for filing the cardboard is provided. The information is crossindexed, retrievable and reproductable on the original cardboard. This list and illustrations explain each step applied in sequence.

1. *Recording the idea*:

The transient idea must be recorded immediately. This requires an ordinary pencil tablet (10c). The 5½x9 inch size with the least number of pages will insure that enough room is available on the back cover for indexing. Over a period of years the number of tablets you fill with ideas will amaze you. Use the most available to maintain some uniformity for storage. The front cover should carry the date of the first entry, when the last entry is made add it to the front cover. These two dates will give you random access to the correct notebook. A clean page is devoted to the idea, no matter how incomplete the idea may be. A simple basic drawing and explanation is sufficient. The date, title or keyword and your signature is recorded at top of page. These items are then entered on the back cover, and is the beginning of the chronological index to provide random access to contents of the notebook. Subsequent entries are made chronologically on clean pages, the date and title is followed by word or words keyed to the change or modification. This is also transferred to the back cover.

When a cardboard is started: The original date, title from your notebook and signature is placed near the top edge. The starting date of the physical work on the cardboard is added on the date you actually begin. In some other area, either front or back, of the cardboard enter all previous and subsequent dates and keywords in chronological order. Include source or reference articles from books and magazines. As development progresses, continue recording on clean pages of notebook, index cover and the chronological list on the cardboard. This description appears to be complex. In practice it is simple because it follows a natural flow of activity and is a chronicle of that activity. If you adhere to this discipline, you will have a cross-indexed record that is nearly fool proof. Experience has revealed that time spent on records is small compared to the time spent on the whole project.

2. *Cardboarding the idea*:

(a) Cardboard stock–ordinary file cards are too light for all but the simplest circuits. Posterboard will handle everything except the heaviest components such as large power transformers. Posterboard is supplied in 22″X28″ stock by stationary and art supply stores.

(b) Cutting stock–household scissors will cut the heaviest stock you will ever use. Illustrations show 5″X8″ cards of various weights. Think small, 3″X5″ think big, 8½″X11″.

(c) Schematic drawing–arrange components so the drawing will form groups of tie points and still maintain a readable schematic. **(Photo 2)** The tie points are a group of several pin-holes. They are spaced about 5/16″ apart. This allows the pigtails to pass through the cardboard separately to merge underneath or wiring side.

The ends are tacked together with solder. This method provides a locking feature for small self supporting components such as resistors, capacitors, transistors and diodes. A jumper wire on either side of cardboard can interconnect tie points. The schematic will be easier to read if components are properly spaced. Study photos 3 and 4. A simple bridged-T filter pad requires a minimum of interconnecting jumpers. The other extreme is illustrated by a cardboard of shielded inductors, switches, jack, potentiometer, crystal holder and transistor. Fortunately the components tend to stiffen the cardboard.

(d) Making the holes—Pinholes are made by a needle-chuck test prod. The larger holes, ⅛" to 5/16", are made by burning, with a modified Ungar type burning kit. Woodburning kits are available in toy or hobby shops. The largest tip is stepped down to four sizes by a small lathe or bu chucking in an electric drill. (Photo 6.) The electric drill is clamped in a vise. The tip is filed down while the drill is running. Diameters between steps is not so important as maintaining a square shoulder between between steps. A flat face at each step will insure clean holes. Holes may be enlarged by wiping hot tip around inside of hole. (Photo 5). Extremely large holes are made by chassis punches. Burn holes can be cleaned with an old toothbrush. A small jar, with ¼" hole in lid, is an anvil. The cardboard is placed over hole of anvil for punching or burning. Anvil will catch any debris from burning and brushing. All the tools are stored in the filebox. Photo 7 of the file box shows all tools used in the cardboarding system.

(e) Recording changes: As development progresses record important modifications in the notebook with suitable index on back cover. The date and keyword is added to cardboard to maintain cross-index feature. When you reach a stage of development where you want to record progress, summarize in the notebook, and complete the cross-indexing routine again.

(f) Termination of development: When the project has been explored to a point where no further progress is anticipated, or development work is complete, the components are removed from cardboard and put back into stock. The final entry in the notebook should be summary with appropriate conclusions. The cross indexing procedure is applied to cover and cardboard again, before filing the cardboard.

3. *Filing the cardboards*:

File boxes are available in several colors, materials and sizes. Prices vary from 50c to several dollars. The file box shown in the photograph is 5"X8", of metal and finished light gray. It has a full length piano hinge and is of excellent quality. The retail price with indexed separators is less than two dollars. The boxes found in variety stores are of lesser quality and retail for less than a dollar. The larger boxes, 8½"X11", complete with separators and lock can be bought for less than two dollars. The use of an appropriate title for the project simplifies filing and access. If you can remember only one date of several that relate to the project, or the title of project, you can recover all the information on the project in a few moments.

4. *Conclusion*:

To insure successful operation of this system these rules must be practiced religiously;

(a) Get that spark of inspiration recorded, even though you write on the palm of your hand with a ball point pen!

(b) Paradoxically, the act of writing improves your memory.

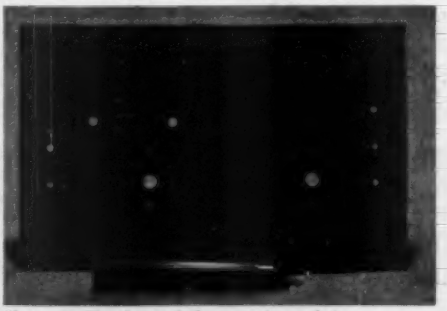

Photo 5. The large holes are burned in.

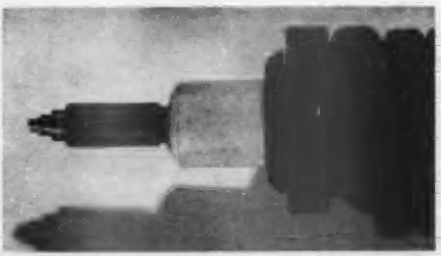

Photo 6. Maintain a flat face at each step on the modified tip.

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Photo 7. All the tools can be stored in the file case. The anvil was made from a discarded D-72 chemical developer jar. The hole in the top was made by the socket punch shown at the left.

(c) Maintain the relationship between notebook, cover index and cardboard entries.

(d) Use jumpers between tie points on the cardboard.

(e) Plan the cardboard drawing to look like a schematic.

(f) Before burning holes, brief your family because they may run around the house sniffing smoke.

(g) Continuous application of these rules will develop automatic reflex action.

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. . . W6FTA

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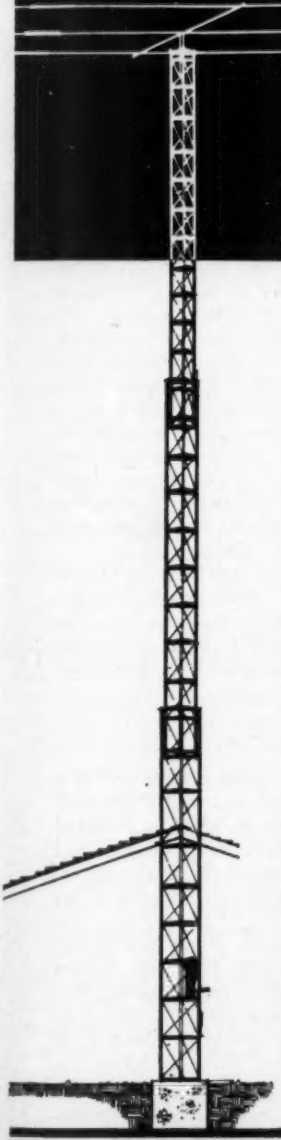

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Buried Antennas for Emergency Communications

In this article, WIDCG describes some of the properties of buried antennas, particularly in relation to their usefulness for amateur Civil Defense or other emergency communications installations.

Many experiments have been conducted with sub-surface antennas in recent years to allow construction of bomb-proof communication sites and for communication with deeply submerged submarines.

Some scientists believe in the possibility of a super-conductive medium in the earth's crust so that antennas could be buried in the ground in an upsidedown fashion and communications established using this "earth ionosphere" much the same as surface antennas work in conjunction with the ionosphere.

However, experiments in this field have not been very successful and a buried antenna, for practical purposes, can be treated as having useful propagation only above the surface. The deeper the antenna is buried, the more inefficient it becomes because of the earth's absorption of the radiated energy.

What application do such antennas have for the amateur? Few amateurs are faced with such a drastic situation that they can't put up some form of surface antenna, even if only attic antenna for short whip. However, for those engaged in Civil Defense or other emergency communications work, the installation of a buried, "back-up" antenna at a fixed station should be considered. It is quite a contradiction to see so many times an emergency communications setup in a relatively protected area—the basement of some public building, for instance—and then to see the antennas on which the usefulness of the installation entirely depends, dangling loosely in the open liable to any extreme surface condition, natural or man-made.

The purpose of this article is to review some of the types of buried antennas which might be useful for amateur emergency communications and to present some of the results the author obtained with a buried 40 meter antenna.

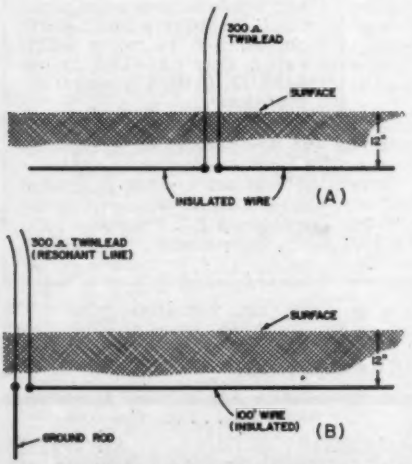


Fig. 1. The dipole (A) and 100 ft. long wire types of buried antennas. Constructional details are given in the text.

Buried antenna properties

Because a buried antenna is immersed in a very lossy medium and because of the sudden difference in medium which, a radiated wave encounters at the interface of earth and air, a number of factors are drastically different for buried antennas as compared to an antenna in air.

Because of the antenna being in a different medium, the length/impedance versus frequency characteristics are different. For instance, a simple dipole buried 1' in soil of moderate conductivity would be about 17½' long for 20 meters and have a center impedance of about 450 ohms. As may be imagined, these figures are very dependent upon the exact conductivity of the soil.

Because of the interface between earth and air, the radiation from a horizontal, buried antenna when it reaches the surface sets up a vertically-polarized ground wave. This factor, of course, is ideal for emergency com-

munications work with vertically-polarized mobile stations.

Antenna forms

Many different forms have been tried for buried antennas and even complex directive arrays have been constructed. However, for amateur purposes, the dipole and 100′ long wire are probably the most useful forms. (Fig. 1.)

The formula for the length of a dipole depends upon ground conductivity as well as other factors and would not be of much use to the average amateur. The best procedure for constructing a dipole is simply to cut it to 80% of the free-space length and then trim the ends equally until the lowest SWR is achieved. If buried in an area where ground conditions remain stable, the length does not have to be changed again.

In areas where ground conditions and surface conditions (snow, extreme changes of vegetation) are not stable, the 100′ long wire should be used. Although an antenna coupler, such as a transmatch, is required to allow compensating for impedance changes with varying ground conditions, the antenna can then also be used for multiband operation. In typical soil the input resistance of such an antenna will vary from 50 to 600 ohms and the reactance from ± j400 ohms over the 2-20 MHz range. The first resonance will be between 750 and 1800 kHz, which makes it effective from 80 meters on down. This type of antenna has been used by the Army in Viet Nam with good results over short tactical distances.

Construction

Whether a dipole or 100′ long wire is used, the wire used for construction must be insulated along its length from the soil and care must be taken that moisture does not penetrate the tips of the wire or the connection to the feed line. Teflon insulated wire, numbers 22 to 26, is particularly suitable. Perhaps a less expensive method is to run plain rubber insulated wire inside plastic hosing. The ground connection for the 100′ long wire can be a standard 4 or 5′ TV type ground rod.

Efficiency

Many methods have been used for measuring the efficiency of buried antennas. Perhaps the most realistic for amateur purposes is to compare the field strength from a buried antenna to a good, surface quarter-wave vertical. Experiments made on this basis have showed buried antennas of the dipole and 100′ long-wire variety, when compared to a surface antenna resonant at the same frequency, to be about 40 db down for a burial depth of 1′. Roughly, this is about twice the order of magnitude reduction in signal strength as would take place between a 8′ loaded 80 meter whip and a full-size quarter-wave 80 meter vertical.

Experimental results

The author constructed a 100′ long-wire buried about 8″ and operated on 40 meters. No impedance measurements were made but proper loading could be easily achieved with the use of a transmatch-type coupler, although some retuning was necessary periodically depending on whether the soil surface was moist or dry.

No surface, vertical 40 meter antenna was available to make signal comparisons but comparisons were made with a 40 meter dipole elevated about 40 feet. On local and short-skip contacts, the buried antenna was never better than 7 "S" units below the dipole with the average being around 8-9 "S" units.

Conclusion

Buried antennas still offer many possibilities for experimentation. The main caution to observe is that the length, impedance and other parameters of surface antennas cannot be used.

Buried antennas are terribly inefficient as compared to almost any type of surface antenna except perhaps extremely short, unloaded whips. But, for emergency communications installations, they do offer the possibility of having a standby antenna which is easily installed and which can be pre-tuned and immediately available for use should something happen to the installation's primary antenna.

. . . W1DCG

Reference

For those who would like further detailed, engineering data on buried antennas, the following compilation of articles is extremely useful: IEEE Transactions, Vol. AP-11, May, 1963. Special Issue on Electromagnetic Waves in the Earth. IEEE, Box A, Lenox Hill, New York 21, New York.

Hank Olson W6GXN
3780 Starr King Circle
Palo Alto, California

A Transistor Wien Bridge Oscillator

In this article, W6GXN discusses the evolution of a Wien Bridge audio oscillator that generates 25-200,000 Hz sine waves with very low distortion.

Virtually every audio oscillator, that the author has ever seen in laboratory use, is of a type called the Wien Bridge. This type of oscillator is characterized by a particular configuration of R-C tuning network. The original circuit of the Wien Bridge Oscillator is shown in **Fig. 1**, as it was first constructed using vacuum tubes.

In **Fig. 1**, the two stage circuit sustains oscillations because of the phase-shift of the bridge (at a particular frequency) *and* the phase shifts of the two amplifiers (assumed constant over the frequency range of interest). Such an RC oscillator would produce a highly nonlinear waveform (like that of another R-C oscillator, the astable multivibrator), if it were not for the nonlinear resistance "r". The resistance r is variously called a positive-temperature-coefficient thermistor, a barretter, or a light bulb.

When the circuit of **Fig. 1** is in its desired state, the tubes are running in class A, and the output is sinusoidal. A change in operating state toward class C (which would produce a much larger output of highly distorted waveforms) causes more current to flow in the R_3-r side of the bridge. This increases the temperature of the light bulb (r), which causes its resistance to rise. The increase in resistance of r causes the gain of the amplifier stage V_1 to decrease, which restores our original operating level.

Front view of W6GXN's Wien Bridge audio oscillator.

To see how the lamp resistance varies with current, **Fig. 2** depicts a (commonly used) 6 watts 120 V lamp E-I plot, with several lines of constant resistance drawn in for reference. The translation of the tube-type Wien Bridge circuit into a transistorized version has had many problems, and the solution of these problems has been so complicated that the basic simplicity of the Wien Bridge oscillator often has been lost. In many a transistorized Wien Bridge audio oscillator, when the problem areas have been designed around, the resultant circuit hardly resembles the original Wien Bridge at all. This is not bad, per se, and several good Wien Bridge audio oscillator designs have come forth using bipolar transistors.[1,2]

Basically, the reason that the Wien Bridge oscillators using bipolar transistors are so hard to build is that ordinary transistors have a relatively low input impedance in the common emitter configuration.

In **Fig. 3**, we see a hypothetical Wien Bridge oscillator using bipolar transistors. Since the input impedance from base to ground is fairly low (approximately $h_{re}xf$), this low impedance shunts R_3 and upsets the requirement that $R_3 = R_4$. Also, since $h_{re}xr$ is amplitude sensitive, frequency will be dependent on amplitude. These two problems generally force the designer to:

1. Use low values of R_1 and R_2, together with large values of C_1 and C_2. This means that resistance tuning *must* be employed.
2. Use some other negative feedback method for controlling amplitude, rather than the simple lamp-in-the-emitter method. Negative temperature coefficient thermistors and forward-biased diodes are two of the nonlinear elements used for this.

With the advent of field effect transistors, the design of simple solid-state Wien Bridge oscillators came within easy reach. The FET has an inherently high input impedance in the common source configuration. However, most of the designs that the author has seen using an FET as the input amplifier, have **not** used the same sort of lamp amplitude control as used in the older tube-type circuits.[3,4,5]

The circuits below were redesigned from the old vacuum tube Wien Bridge circuits, for simplicity and ease of understanding. The first attempt, **Fig. 4**, used the same type light bulbs as do many of the tube type oscillators, and also used capacitive tuning.

The circuit of **Fig. 4** used one of the relatively new insulated gate FET's, the RCA 3N98. With a maximum design-capacitance in each section of the variable capacitor of 500 pF, at the minimum operating frequency, very high resistances (many megohms) were required for R_1 and R_2. At such a high impedance level, the circuit readily picked up 60-Hz ripple, and it was quite essential that it be enclosed in a shielded cabinent.

The bridge-sensing amplifier was the only FET in the circuit, since this was the only place where one was *needed*. A conventional bipolar voltage amplifier Q_2 and a complimentary emitter-follower completed the oscillator. The emitter-follower was used to provide a low output impedance. The circuit was powered by a separate +28 volt regulated supply.

Since the main frame of the dual variable capacitor was the common terminal, which was connected to the gate of Q_1, one would expect a fairly large stray capacitance to ground in shunt with C_2. This had to be equalized by a trimmer (C_3) across C_1 if oscillation was to be maintained near minimum C settings of the dual variable. Also, of course, an insulated (ceramic) shaft coupling had to be used on the variable capacitor shaft and the capacitor frame had to be supported by ceramic or high-quality plastic insulators. C_4 and C_5, in parallel with C_1 and

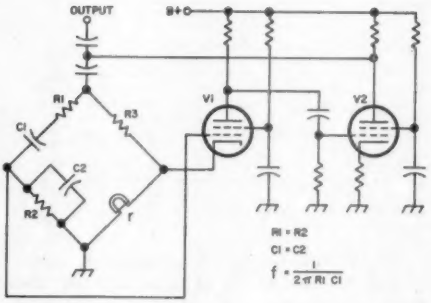


Fig. 1. Typical tube-type Wien Bridge audio oscillator.

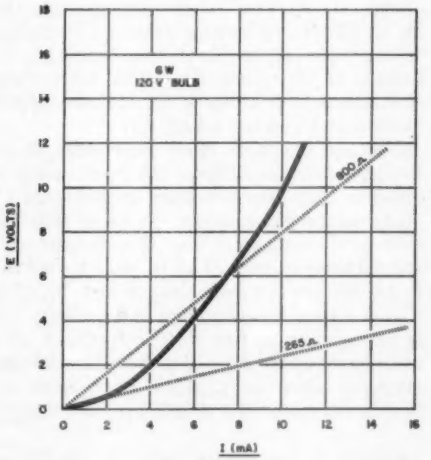


Fig. 2. E-I plot of a 6 W, 120 V pilot lamp. Two constant resistance load lines are also shown for reference.

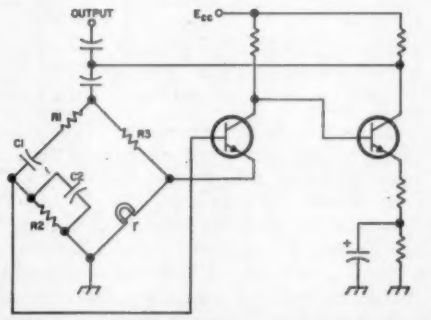


Fig. 3. Theoretical transistor version of the Wien Bridge shown in Fig. 1. Unfortunately, this simple adaptation isn't satisfactory because the low input impedance of the first transistor appears in parallel with R2 and loads it too much.

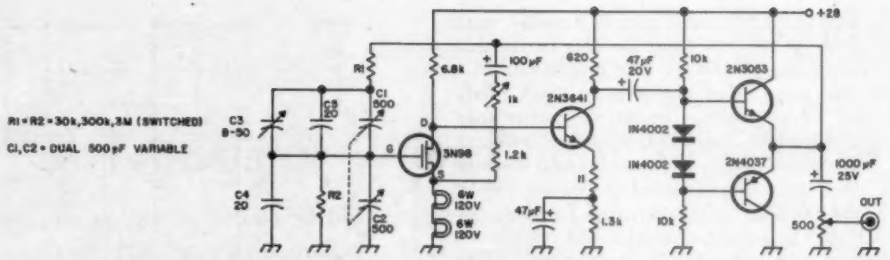


Fig. 4. First version of a moderately successful Wien Bridge oscillator. For low frequencies, R1 and R2 have to be so large that the circuit is very susceptible to noise and hum.

C_3 were simply to fix the minimum tuning capacitance.

The design worked quite well in the ranges above 100 Hz, but the lowermost range (10 Hz to 100 Hz), where the required resistance values were 30 megohms, was unreliable, as feared. At this point, capacitive tuning was abandoned in favor of a combination of capacitor and resistor switching.

The second and more successful Wien Bridge audio oscillator was built using a junction FET. By switching both R and C, bridge component values are more manageable (and available). The C values in this second version are 0.52 µF to 500 pF, and the R values are between 100 Ω and 3300 Ω. **Fig. 5** shows the circuit of the oscillator; it is very similar to **Fig. 4.** The feedback control element used here is a Sylvania 120 MB lamp for which a typical E-I curve is shown in **Fig. 6.** Note that this lamp allows us to use a single bulb to operate at a source resistance of about 600 Ω. Also, the Sylvania 120 MB is physically smaller than most 120 V bulbs and fits a small bayonet pilot lamp socket, like that for a #47 or NE51. The lamp is available from Allied Radio for $0.46. The oscillator is constructed in a LMB-WIA cabinet, as shown in the photos.

The capacitors are switched only each decade, and the resistors are switched in ten increments between decades. The seemingly-nonsensical increments of frequency were chosen to give points that are approximately evenly-spaced on semilog graph paper—the type of paper usually used when plotting the frequency response of an audio amplifier. The four pairs of capacitors were "built-up" starting with 0.47 µF, 0.047 µF, 0.0047 µF, and 470 pF capacitors, by adding small capacitors in parallel; a bridge was used. The resistors were all 1% tolerance types from

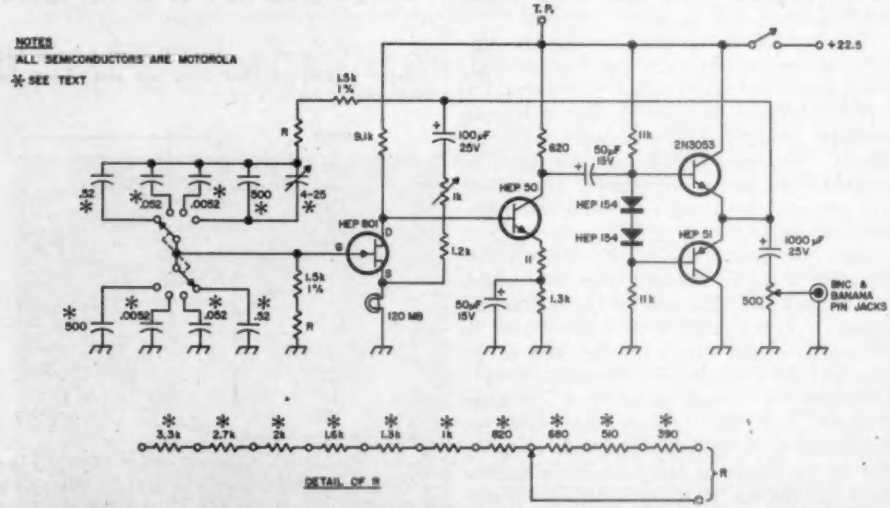
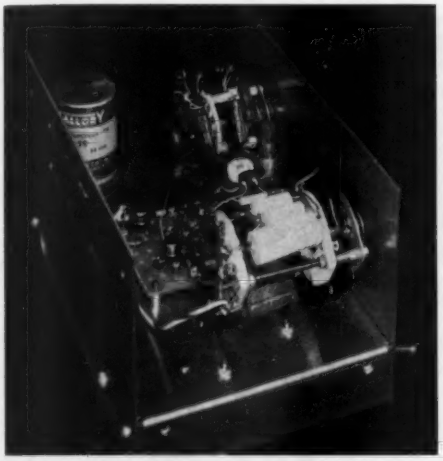


Fig. 5. The most satisfactory version of the Wien Bridge oscillator. This circuit is used in the oscillator shown in the photos.



Interior of W6GXN's audio oscillator.

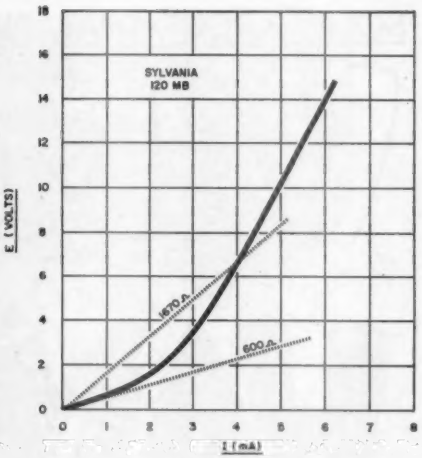


Fig. 6. E-I plot of the Sylvanis 120-MB pilot lamp.

a local surplus emporium; Their marked values were trusted.

As in the first oscillator, a small trimmer capacitor was placed in parallel with the C in the series arm of the bridge to make up for stray capacitance to ground (and the input capacitance of the FET.) This trimmer was not necessary except on the high range, where 500 pF capacitors were used.

A burgess U15, 22½ volt, battery was used to power the oscillator. It is mounted under the chassis in an Austin #113 battery clip. In this mounting configuration, the battery cannot damage the circuit board if it leaks. A test point is provided on the rear of the cabinet to test the battery voltage *under load*.

A quick check at 1000 Hz revealed that second harmonic content of the waveform was 48 dB below the fundamental. Higher harmonic content was greater than 50 dB down, with the even harmonics being the strongest. The output amplitude was within 1 dB across the entire frequency range.

The author wishes to thank Gene Howell, WB6JOV, for the photographs of the audio oscillator.

. . . W6GXN

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5. Silinconix Incorporated, **FET Circuit Ideas** May 20, '66 p.3.

Proof Positive

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. . . W. R. Lingenbrink W6HGX

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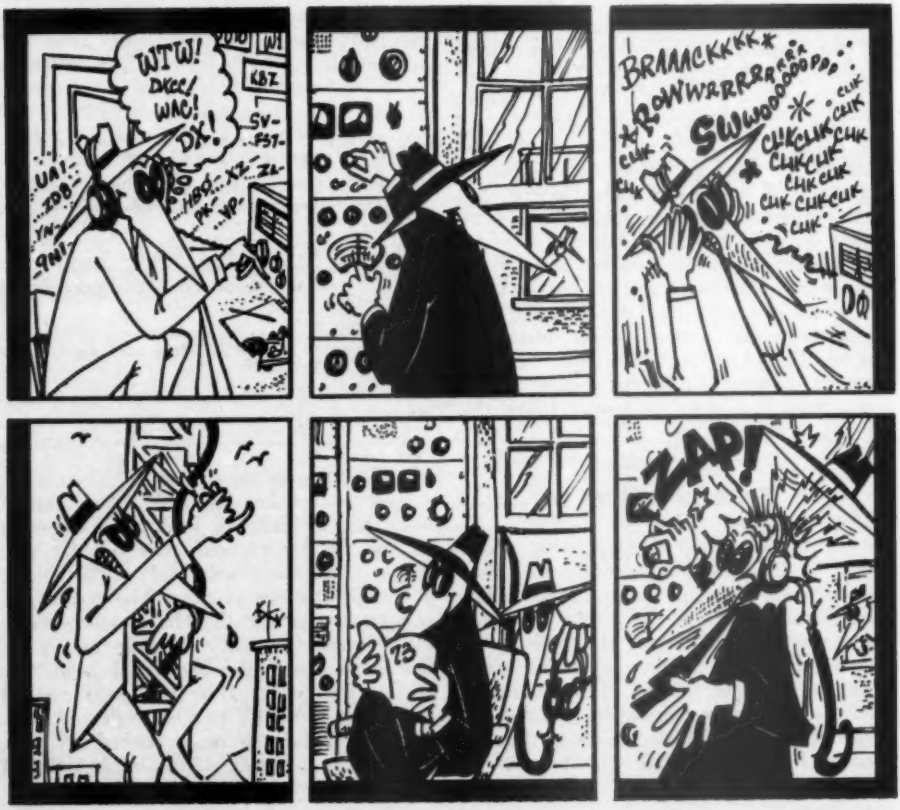

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Alan Biggs W3ZP
MR 2
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Have You Tried Air Mobile?

By some strange coincidence, the number of licensed hams roughly equals the number of licensed private and civil pilots. A guess would also suggest that the number of active stations would also approximate the number of active civilian aircraft (100,000). It also holds that there are a number of hams who are actively interested in flying. What the percentage is, I don't know. At a recent luncheon of fifty hams at the Colt's Neck Inn, six where active pilots, and at least two make it a regular practice to operate air mobiles. There must be a lot of interest, for whenever I operate from my plane, stations are always asking for detailed information on the equipment used, particularly the antenna.

I have tried many different arrangements, in different planes, with varying results. These range from meters in a luscombe in 1939 to a crystal controlled H W -12 in a Stinson from Isla Mujeres to Kew West in 1966. The results have been both good and bad. When I operated five meters in the Luscombe I used a superregenerative receiver. Since the flight (only one) was in the metropolitan New York area, everything could be heard (including ten meter harmonics), but with the poor selectivity of the super regenerative receiver, nothing could be copied.

Crystal-controlled HW-12 under the rear seat of the Stinson Voyager. Photo by W3PYF.

In the 1950's many of us took part or heard of the work of Arthur Collins, General Butch Griswald, General Curt Lemay and others when they so effectively demonstrated to the Air Force the benefits of SSB for HF air-to-air and air-to-ground communications. For the past six years all my airborn hamming has been on SSB. Different planes and different equipment have been used but always with the same satisfying results. With the adoption of SSB and the availability of light, efficient transceivers, the utility and effectiveness of airborne ham communication has been greatly enhanced.

Our first use of a modern transceiver in a plane was with a KWM-2 in a Bellanca Cruismaster in 1960. In this case the KWM-2 was set on the rear seat, the power supply on the floor and all connections were made to a terminal plate about 3" x 12" on the lower right panel of the rear of the seat. Use of this panel avoided alternation of the plane's weight and balance. The plate had outlets for 12 V DC, Audio, and antenna. The antenna and audio used phono jacks and the 12 V DC used standard 110 V polarized female outlet. Naturally it was fused. For an antenna, there was the fixed-sense antenna for the ADF which ran from the top of the cabin to the tail. It was just short of a quarter wave for 20 meters.

A switch was added over the pilot's head, which changed this antenna from the ADF to the outlet plate in the rear through a loading coil and coax. This loading coil made the antenna resonant on twenty. There were other positions on the switch which provided for operation on 40 and 75 but very little were done on these frequencies as the performance there left much to be desired. I have never had much luck from the plane

on frequencies where the antenna was not nearly resonant in itself, or where it needed a large loading coil. This arrangement was used with great success on many trips to Florida and one from Florida down through the Bahamas to Haiti, the Virgin Islands, Puerto Rico and back to West Palm Beach in February, 1962. All of the trip was on twenty meters. There was constant communication from our take-off at Stuart, Florida, heading out over the water to Great Exuma, with one stop at Grand Bahama. Communications were solid. There was a brief time after the ground wave gave up and before the sky wave came in when contacts were made with stations in the north, but at no time were we out of contact on the ham radio. In fact, when we were in sight of West End, Grand Bahama, and could not raise Palm Beach on the aircraft VHF radio, Bud Walker, W2EE/4, parked in his car in front of the Palm Beach Tower, stepped in and closed our flight plan for us after getting our request for the same on twenty meters.

This was my first experience at over-water flying in a single engine plane. As they say, the engine always goes into automatic rough when over water, and this was no exception. What a wonderful relief it was to have W4RNT and many others ready to summon help immediately if it was needed. It wasn't until after our return that I learned that Babe, W4RNT, my anchor post, could not find Georgetown, Great Exuma, on his maps spread on the floor of his shack as he followed our course. After an overnight stop at Georgetown, we left early for Port-Au-Prince, Haiti. The whole crowd was waiting for our appearance on twenty meters which kept us company constantly.

At Port-Au-Prince we were met by HH9DL who escorted us to his plantation on the north coast, near Cap Haitien. Don, HH9DL, whom we had met on twenty meters, also is a pilot. After talking to him several times on twenty meters we accidently met while we were both grounded in Salisbury, Maryland, on account of weather. He has been flying his Cessa 195 back and forth between Miami and Haiti for eight or ten years. It was his encouragement that inspired me to make this particular island hopping flight.

Don helped us clear customs, which spoke only French, then led us, in his 195 back north to the plantation, about a hundred

Alan W3ZP and his wife as they prepared for a flight to the Virgin Islands. Photo by W4RNT.

miles. It took only 45 minutes by air but would have been an all day ride over impossible roads.

A few beautiful days were enjoyed at the plantation, where the hospitality included their Mar'd Grau. HH9GR, George Rippey, and HH9DS, Dick Smith, are also with the plantation Dauphine.

Returning to Port-Au-Prince for one night and some shopping, there was an early take-off and over the mountains skirting the Dominican coast some 30 miles over Mona Island, Puerto Rico and landing at St. Croix, Virgin Islands. non-stop.

At no time was there any breakdown in the ham communications with any stations following our course constantly. Very comforting as, for the most part, it was our only communications.

The return trip went about the same way. To San Juan, then over water with no sight of land for some 500 miles to Great Inagua. A gas stop there and then non-stop to West Palm Beach. The ham contacts were continuous. Between Great Exuma and Nassau, we talked to, passed, but never saw, W1PRI, who was flying his Bonanza south and operating his KWM-2 on twenty meters too.

Frank Melville, W2AQK, followed us that

The HW-12 DC supply installed under the rear seat of the Stinson Voyager. Photo by W3PYF.

Electric antenna reel control and reflected power meter. Photo by W3PYF.

day by about an hour, but we did not see him after leaving San Juan. He had no air mobile, just a KWM-1 which he carried in his baggage. He had set it up on St. Croix. With no air mobile, he was sort of out of the club.

After that trip, and at W1PRI's suggestion, we obtained a surplus WW2 electric antenna reel, which are so plentiful. They are designed for 24V DC, but they work quite well on 12 V. They are used with a reflected power meter. Just run the antenna out till there is minimum reflected power. This is done for any frequency and provides excellent performance; - far better than the shorter antennas. Of course remember to reel in the antenna before landing or carry along a lot of spare antenna wire. We have used 40-lb. test phosphor bronze fish line successfully at 100 mph speeds, but heavier wire, with a cotton center, is necessary for the 150-200 mph speeds. A two to four inch plastic funnel on the end of the wire serves as an effective drag.

Antenna and funnel hanging from the belly of the Stinson Voyager. Photo by W3PYF.

If you do make any trips with an air mobile, you will probably find that you will want some ham radio at your destination or stops. Take along an ac supply and some wire for an antenna.

Later the KWM2 was replaced with an HW-12 crystal controlled on 3999 per April 1965 QST. With the superior performance of the long antenna, distances up to 800-1200 miles can be covered consistently without the dead spots of the higher frequencies. Later this whole set-up was taken from the Bellanca and installed in a 1948 Stinson. As shown in the photos, here again everything is plug-in. Not only does it simplify conformance with the FAA regulations but it is also possible to take the HW-12 and power supply from the plane to the car in a few minutes.

In the winter of 1966 a fine trip was enjoyed in this Stinston. Starting from near home at Doylestown, Pennsylvania, one bitter cold morning, the night was spent at Memphis after stops at Cleveland, and Bowling Green, Kentucky. The next night it was Rockport, Texas. Then on around the Gulf with stops at Tampico, Vera Cruz, Ciudad Del Carmen and across the Yucatan jungle to the isle of Women, Isla Mujeres.

If you examine the radiation pattern of a horizontal antenna as given in a handbook, you will see that there is a lot of very low angle radiation from a horizontal antenna many wavelengths high. This is born out in practice from the plane. Signals on the long skip are very good. There was no problem working clear across the gulf on 3999 even during the middle of the day. The distance was as much as 1000 and 1200

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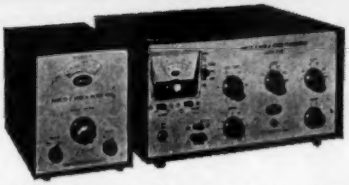

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miles. I have also noticed times when I could hear and work these long distanecs while they could not be heard at fixed stations directly below me.

An Ac supply was carried on this Mexican trip along with a portable antenna. It came very handy on the Isle of Women. The operation there was not legal, as we had not gotten a Mexican license and there were no hams on Isla Mujeras whose calls we could borrow. Of course we were not legal flying over Mexico either. We always signed our location as south of Brownsville.

We were held up at Isla Mujeras by bad weather for several days. There was no way of getting weather reports or forecasts. We particularly needed to know the winds-aloft forecast for Key West in order to calculate our ability to reach Key West, 400 miles away, with the fuel we had aborad. One morning, before the weather had cleared, we had a brief contact with Art Lynch, W4DJK, in Fort Myers, Florida. All of those contacts from Isla Mujeres were brief. Our hotel room was less than 100 yards from the government radio station. Their key clicks were loud and I did not want any questions asked about the legality of my operation. Art called the airport in Fort Myers and got a favorable wind and weather forecast. Even though the weather looked bad where we were, with rain and low clouds, we took off keeping low and under the clouds in rain. The weather did improve after we were about 200 miles out. It is a good thing we had that report from Florida for had we not made it that one day, the weather was bad for the next two weeks. Also, it is extremely hazardous to fly into unknown weather when you are forced to stretch your fuel supply.

During this flight was the only time we lost ham communications. Nothing could be heard on the receiver. Later I found it was just a short in the speaker plug, but it did put us out of business. The boys in Florida did hear my transmissions, I learned later. On landing at Key West, I phoned Arthur immediately and relieved the concern of the many stations listening.

As with automobile mobile, air mobile is more useful on a long trip than on a short trip. I feel that it is a must for trips outside the country where public communications may be spotty. It has certainly proven itself to be very useful. . . . W3ZP

Tom O'Hara W6ORG
10253 East Nadine
Temple City, Calif.

FM Subcarrier Generator for Ham TV

Amateur television, or ATV, is beginning to become quite popular. The availability of inexpensive vidicon cameras and the many articles appearing in ham magazines about TV have made it possible for the ham who wants something different, but not too difficult or expensive, to try ATV. However, one big problem of ATV'ers has been transmitting audio. One method is to use a completely separate transmitter and receiver system, as for example on two meters. This requires a lot of extra equipment and cost, and means that your audio cannot be received on a standard TV set used for video reception with a converter.

Another method of transmitting audio is to use a completely separate transmitter 4.5 MHz away from the video carrier and either feed the audio signal to another antenna or through a complex diplexer to the common 440 MHz TV antenna. This method is also expensive as it requires a complete transmitter and power supply for audio.

A better approach, I feel, is the simple 4.5 MHz FM subscriber generator described in this article. It produces more than 1 V P-P carrier which can be fed into your video modulator either at the camera end of the cable, or at the modulator. The components are not critical; the transistors can be almost any of the inexpensive new epoxy-cased types.

The circuit (shown in Fig. 1) consists of two stages of audio amplification from a high-Z microphone feeding a Varicap-controlled oscillator at about 4.5 MHz. The Varicap changes capacitance at an audio rate giving true FM output. The fourth transistor is used for isolation and to provide a low impedance output.

The generator can be built in many different ways: Vector board, Veroboard, etched circuit board, etc. A convenient method is to use plain insulating board with holes drilled for components and jumper wires for connectors. Care should be taken to prevent ground loops or pick up from long leads if used on the same chassis with a transmitter

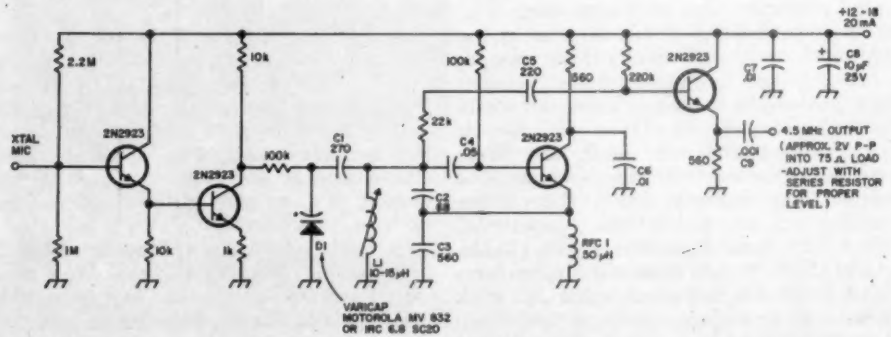

Fig. 1. A simple transistorized FM subcarrier generator for transmitting audio on a video transmitter.

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and modulator. The best way to wire the circuit is in the same order as the schematic.

The generator is easy to test. Apply power, and if nothing smokes, listen for a signal on a general coverage receiver tuned to 4.5 MHz. Adjust the slug of L1 if necessary. Then connect a crystal or high impedance dynamic mike and check for FM audio output by listening to the receiver. If you don't have a receiver that covers 4.5 MHz, you can connect the generator to your video monitor if it has an audio as well as video input, or connect the generator to your modulator and transmit on the air.

Unless you have a scope with response out to 5 MHz, it is hard to tell how much audio subcarrier voltage to out with the video. The usual ratio is 1 V video to ¼ V P-P audio at the modulator input. This is assuming that your modulator is flat out to 5 MHz. If it is not, then you can peak it up at 4.5 MHz by adding a tuned circuit as shown in **Fig. 2.** This added circuit may give you greater definition, too.

Now as for the transmitter, tune the final to favor the upper sideband since your receiver is tuned that way. The only drawback with this system is that the audio is going out on the video carrier, and subtracts a little power from it. It's only a small amount, and shouldn't make much difference.

This method has been used successfully in the Los Angeles area. It enables simultaneous conversation between hte transmitting and receiving stations for quicker and better fine adjustments .

For any reader who doesn't feel like making his own generator, I can supply the finished unit on a printed circuit board for $15 postpaid.

. . . W60RG

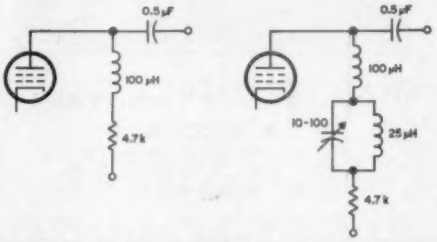

Fig. 2. Improving your video amplifier-modulator's response at 4.5 MHz. A typical circuit without a 4.5 MHz peaking circuit is shown at left, with the added components at right.

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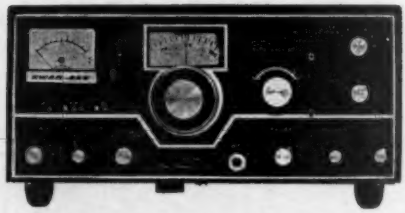

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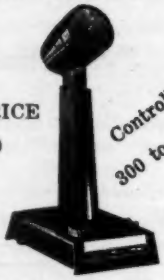

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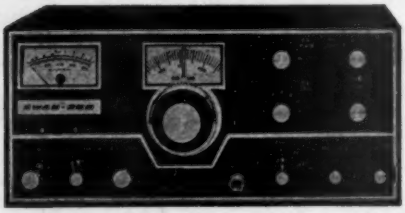

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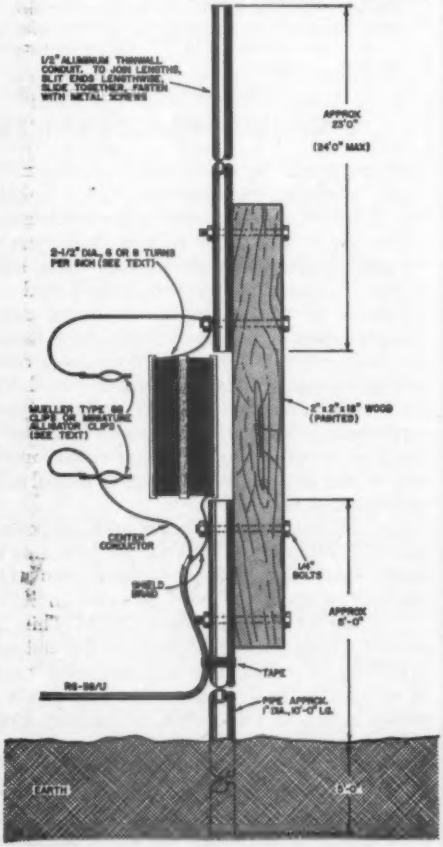
. . . John Sharples WA9MYR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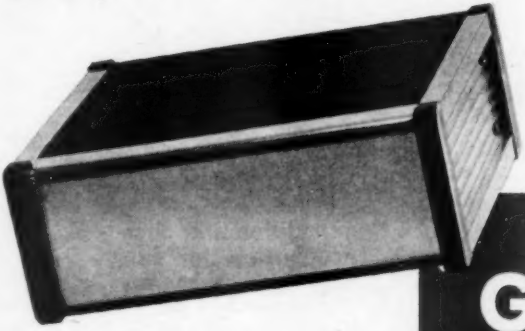

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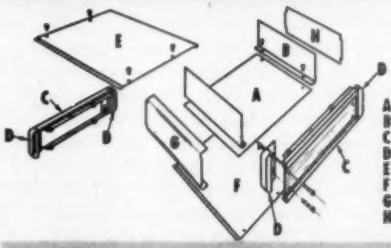

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James Dandy Diode Tester

Jim Ashe W2DXH
Freeville, N. Y.

If you've wondered how to check the condition and characteristics of junk box diodes, here's an article for you. It's a simple, inexpensive tester for low voltage diodes.

I think that semiconductor diodes are almost as useful in circuit construction as resistors and capacitors. Used properly, diodes are good for all sorts of tricks beyond detecting rf and rectifying ac. Well, I recently saw a chance to acquire a huge batch of assorted computer types at an irresistible price (five dollars), and my resistance being what it is, I bought them all. But when I got them into my lab, a new perspective emerged: which ones are good? As I was sorting out the color coded varieties, I developed an idea.

Like Topsy, the idea growed up! It became a schematic and some simple calculations. It developed into a mess of clip leads and components attached to a Heathkit oscilloscope. And finally I built . . . a James Dandy Diode Tester.

This simple circuit tells which end of the diode is which, what its reverse breakdown characteristics are, and it gives you a rough indication of quality. You'll have to try something else if you're interested in determining rf performance or pulse risetime and turnoff characteristics, but you can tell if it's worth further attention. The Tester also checks zeners and transistors by observing the properties of their inherent diodes. And maybe there are one or two other uses we can find for it.

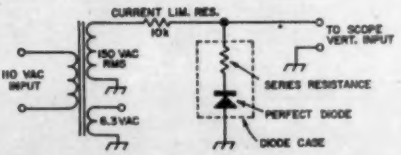

Fig. 1. Basic circuit of the Tester.

Theory

If we pare all the trimmings off the James Dandy Tester schematic, we end up with Fig. 1. This shows a high-voltage transformer in series with a resistor and a diode, and an output terminal added across the diode. Note that the diode points up. A second winding which provides the scope sweep voltage is not needed for a basic explanation. So let's work out what happens when the circuit is turned on. The key lies in the diode properties of reverse breakdown, forward conduction, and internal resistance.

The dotted box in Fig. 1 represents the shell of the real diode. Electronically we can never open up this shell and find something inside that visibly accounts for what the diode does. But we can suppose there's a perfect diode inside the shell, and a resistor that somewhat spoils the diode's properties. Then we can describe the real diode's behavior in terms of this model. My diode-

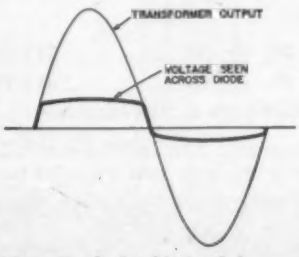

Fig. 2. Where the diode characteristics curve comes from.

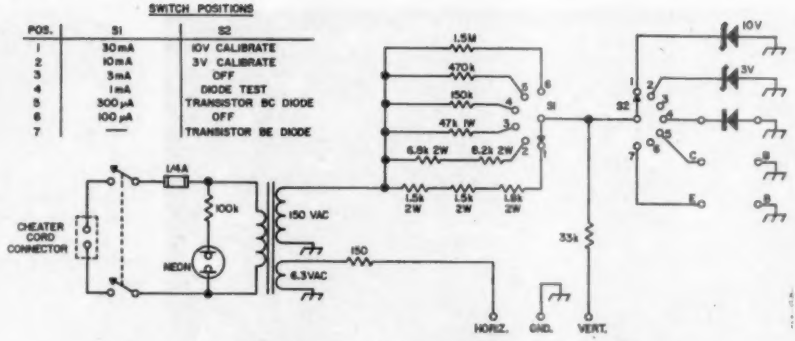

Fig. 3. Complete schematic of the James Dandy Diode Tester.

resistor model is very simple but it'll get by for now. So let's say the perfect diode goes into reverse breakdown at 20 volts, forward conduction at 0.7 volts (appropriate for sli- resistor has the rather high value of 100 con, choose 0.2 volts for germanium) and the ohms.

Fig. 2 illustrates the resulting situation with two superimposed curves. The upper curve represents the 150 volt RMS sine wave, always seen at the transformer terminals. The lower curve shows what we see at the diode terminals, generally a much lower voltage. Let's follow this through a complete cycle.

Starting at zero volts and going in the positive direction, we follow the sine wave along its natural course until it reaches 20 volts. At this level the diode goes into conduction, and the circuit sees the 100-ohm resistor as a heavy load with its bottom end held at 20 volts. This state continues until the transformer's sine wave returns to the 20 volt level on its downward swing. Then the diode goes off, we return to the sine curve, and follow its natural course back to zero.

The 150 volt RMS wave goes to 212 volts peak at the center of the half-cycle. We see roughly 200 volts across 10 Kilohms, or about 20 mA at this instant. Passing through the diode's 100 ohms, this current adds 2 volts to the perfect diode's 20 volts. We will have to push the top of the diode voltage curve up a little bit, and we should round off the corners since that's what we expect to find in a real circuit. This is how we get **Fig. 2**, which very closely resembles the real curves you will observe using a triggered or saw-tooth sweep.

The negative half-cycle closely resembles the positive curve, but the break points are very much closer to zero. The (silicon) diode takes over at 0.7 volts rather than 20 volts, and the curve bulges in the opposite direction because the current flow is reversed.

My transformer has a 6-volt heater winding which I put to use as a horizontal sweep source. This gives a linear presentation. That is, starting at the center of the trace, which should rise towards the right, percentage of distance to the end equals percentage of peak applied voltage. This eliminates using a simple trig equation if you want to know the diode current at any part of the curve. And it gives a presentation closely resembling the manual and textbook illustrations. By changing some output connections you can get an exact correspondence.

Depending upon conditions of operation, 200 volts or more can appear at the Tester output terminals. If you're looking at fine detail in the diode characteristics, this could be applied directly to your scope's input tube. The 33k resistor in series with the vertical output terminal limits current flow under these and short-circuits conditions to

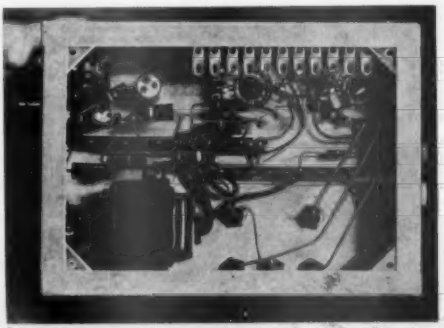

Fig. 4. Bottom view of the Tester. The calibration zeners are on the lug strip at the upper right hand corner of the chassis.

Fig. 5. Top view. I finished the Tester with slow-drying enamel and freehand India ink lettering.

5 mA or so at the price of a slight loss in signal amplitude. A much larger current is available at the diode test terminals, so watch your fingers! Turn the Tester off when changing diodes.

Construction

Fig. 3 shows a complete schematic of the Tester. Those protective resistors and the two-pole power switch might seem a little elaborate to you. But I've been in this field for some time and I think I've blown as big fuses as anybody, and got bit a few times too. The lots of little precautions like these tucked away in everything I build add up to a pretty fair insurance policy for me as well as the gear.

A 5x7x2 chassis serves as case and panel, and a bottom plate makes a worthwhile improvement. All wiring is point-to-point, and three 11-lug solder strips provide additional useful tie points. About half the lugs actually got used. Fig. 4 shows a bottom view of the Tester.

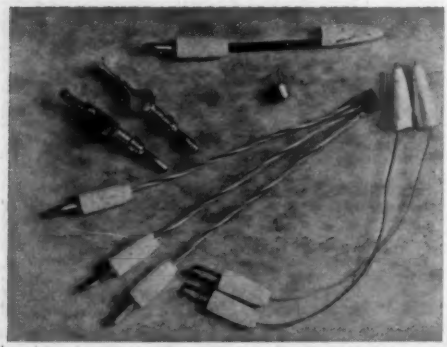

Fig. 6. Assorted leads for the tester. They go well with the Heathkit transistor tester too.

You can see the transformer in the lower left hand corner of the chassis. If your transformer won't go in upside down there is lots of room on the back wall. The AC cheater-cord connector goes in the LH side wall beside the transformer, with a half-inch of clearance around its solder lugs. The fuseholder is in the same wall perhaps two inches forward. There wasn't enough room for it on the top, and fuseholders aren't very interesting anyway. I might have used a TV solder-in fuse and saved cutting a hole.

On the top surface, three rotary switches and a neon pilot lamp are mounted on the same line slightly more than one inch from the front wall. See Fig. 5. With the transistor and diode terminals toward the rear, there is a clear area across the inside of the chassis which takes two of the three 11-lug strips.

I used banana jacks for all test and output connections. They seem to be more convenient than anything else. Fig. 6 shows a collection of connecting adapters made up for the Tester. The ones on the left are made up of Grayhill #2-0 breadboarding terminals soldered onto banana plugs, and they are particularly handy when testing diodes. The others are make up of banana plugs and some light and some heavy wire, with Mueller's micro-gator clips. The more common alligator

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clips just don't get a grip on fine wires and transistors leads. Somewhere in there is a transistor socket with short leads, which I might have color-coded emitter yellow, base green, and collector blue. These assorted adapter leads tend to congregate on my Heathkit transistor tester when I'm not checking diodes.

A rotary switch turns the power on and off. I always use a rotary switch in this critical location. A toggle switch could collapse someday, accidentally turning on the circuit. A rotary switch can't possibly do that,

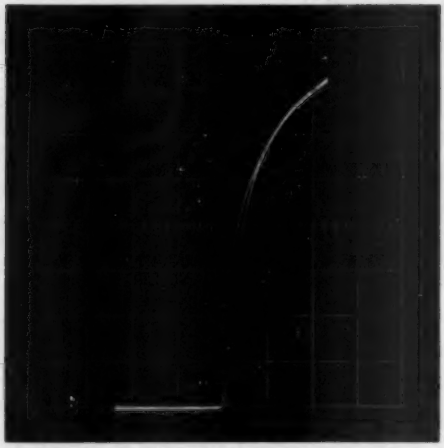

Fig. 7A. Germanium diode characteristics, showing gradual breakdown with increasing reverse voltage, and low forward resistance.

Fig. 7B. Another germanium diode, showing a sharp knee but poor dynamic resistance.

and its general health is immediately apparent just by looking at it. I like that.

The other two switches are single-pole non-shorting (make after break) rotary switches, and any of several varieties are usable. Mine were assembled from CTS parts, purchased in little boxes and then you assemble what you need. I see some nice switches in Allied's #260B catalog on page 308. They are Mallory's Series 3200J non-shorting single-gang switches, and they come already assembled.

When you are finishing up the circuit, leave the transformer heater leads a little loose. You may want to reverse them. Before you finalize things, hook up the tester to a scope, set the scope to very low vertical sensitivity, and see which way the trace goes. It should be a straight line, rising to the right. That is, if a positive voltage to the scope's vertical input deflects the spot upwards, and to the horizontal input deflects the spot to the right. Otherwise you may have to redraw the curves shown in the illustrations.

The calibrating diodes go in last. Finish up everything else, and use the Tester to choose them. They'll be zeners or other diodes that show good zener characteristics. Details follow shortly.

Component values in this circuit are not critical because I don't expect too much from it. If I need exact measurements I get them somewhere else. I've chosen properly sized resistors so you can leave it on all night without anything roasting. If you want to change those resistors, it's easy. Ohm's Law:

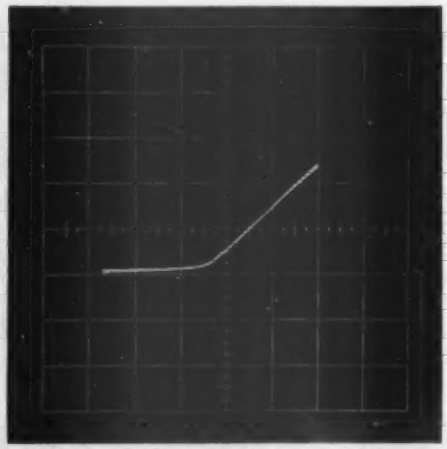

Fig. 7C. A germanium diode after overheating. The scope gain is very high, so we see that its diode characteristics are nearly gone.

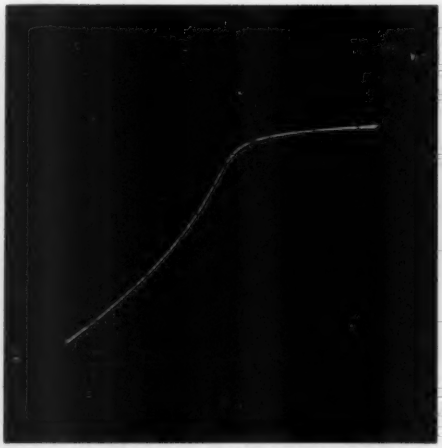

Fig. 8A. BE diode of a germanium transistor. Downward curve indicates a PNP transistor, and rather vague conduction and reverse characteristics suggest high leakage.

Fig. 8B. BC characteristics of the same transistor. This curve is also downward, and it shows a very sharp conduction and breakdown knee.

RMS voltage over resistance equals RMS current, and you can see in **Fig. 5** which values I chose. If you can't find a 150 volt transformer, compute new resistances for what you have available. I wouldn't use a lower voltage because some transistors and small diodes show breakdown voltages in the 100-volt range.

The case is finished off with good enamel and careful hand lettering. I won't go into detail on that because it's pretty well covered by my article on the subject in the March 1967 73.

The calibrating zeners

If you have a scope with fixed voltage ranges, you probably aren't interested in the calibrating zeners. If not, you need them, but how are you going to find out what their values are?

Perhaps you have some zeners of known characteristics, but the usual 10%, 20% or greater tolerances seem rather excessive. If you're familiar with your VTVM, you may have guessed the answer already: use its ability to indicate peak-to-peak AC voltages.

A review of the meter manual should answer any questions that may arise. So far as I know, all inexpensive VTVM's use a peak-reading circuit, with a meter scale that is labeled for sine-wave readings. We'll just convert those estimated sine-wave figures right back to P-P, by multiplying by 2.82. Or perhaps, like my Paco, P-P scales are included on the meter face.

Set up the Tester and your oscilloscope. Attach your meter ground lead to the Tester ground return, and the meter probe to the scope Vertical Input terminal. Set the VTVM for AC measurements and start testing diodes. When you come to a diode that has nice sharp corners and flat top and bottom, make an RMS reading, convert to P-P, and you have that diode calibrated. I think 3 volts is a little low, because I went through nearly a hundred diodes and transistors before I found one of this value; you might try 5 volts and you'll find one quickly. Three more of them would add up to 15 volts, and these are probably better choices than 3 and 10 volts.

Remember to make your measurements at the same current you will use when calibrating the scope. My zeners give true readings at 1 mA; you'll get sharp corners more easily at a higher current.

Testing diodes

The quickest way to understand the Tester indications is to put a diode in it and then work out the meaning of the different parts of the curve. Repeat with several different diodes. Most everything you need to know is in the theory section, and in several widely distributed handbooks. Just take a little bit at a time and ask, how did it get that way? I've included some illustrative photos and

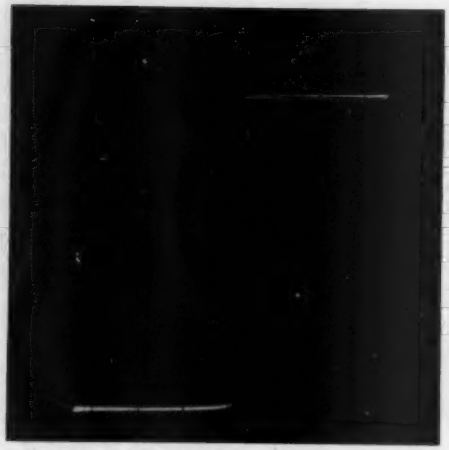

Fig. 9A. It's not obvious here, but this silicon transistor BE diode curve turns upwards.

Fig. 9B. BC characteristics of the same transistor. I don't know what causes the very noticeable phase shift. Can somebody tell me?

brief explanations.

All bipolar transistors have two inherent diodes. One is the base-emitter diode, and the other is the base-collector diode. The Tester checks these diodes one at a time, and it doesn't tell you anything about how the transistor will work. But if one of the diodes is bad, the transistor won't work. And the direction the curve goes indicates whether you have a PNP or an NPN transistor. See Figs. 8 and 9.

Why do many diodes show a double line in the vertical parts of the pattern? These lines merge at higher currents but are very distinctly separate for small currents and large diodes. I think this is phase shift of the applied voltage through the RC network of series resistor and reverse-biased diode capacitance before it goes into breakdown. In that case, the LH line would be the rightward-going trace (phase retarded).

Zener regulators

Do you have trouble finding zener regulators? The Tester will find lots of them, and tell you how they'll work in your circuits. It's so handy for checking zeners it belongs in my zeners article (73, October 1966) but when I wrote that I hadn't thought of it yet.

It turns out that not only specially built silicon diodes will serves as zener regulators, but some unspecial diodes and even germanium transistors! The Tester finds the ones that can regulate, and some of you out there working with low-power circuits can now find very low-power zeners to go with them. Wish I'd found out about this sooner! I haven't done any work in the matter, but I expect germanium zeners aren't going to show as good temperature stability as silicon zeners. Well, that is another problem. Fig. 11 shows the base-emitter breakdown characteristics of an unlabeled germanium computer transistor from somebody's printed circuit board.

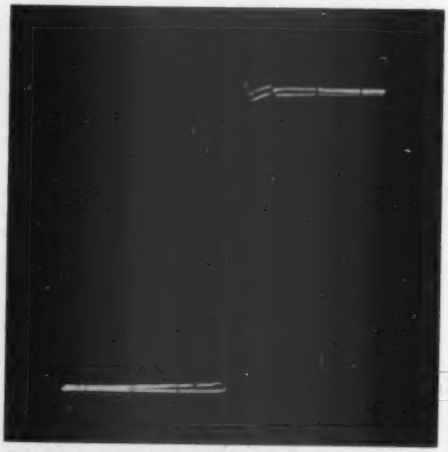

Fig. 10. A very close look at a perfectly good GE Z4XL6.2 zener diode. It shows some zener noise under 200 microamps, and low dynamic resistance.

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Closing comments

The Tester can supply lots more power than is required to roast a good diode into complete uselessness. Fortunately, this is harder to do than you might think. The power dissipated in the device is the usual product of voltage times current, and since most transistors and diodes break down at under 20 volts, and can take over 100 milliwatts ,the average danger line lies around 5 mA. But some transistor may unexpectedly show a base-collector breakdown at 50 volts or more, and if it's rated at 60 mW you may easily overdo things. I hope you'll try to roast a few semiconductors to get a feel for what you can and cannot get away with . . . just watch the scope and you'll see the curve begin to slump off towards a straight line. Then heave the poor thing into a nearby wastebasket so it can't end up in one of your circuits.

If you're careful to use things only for their intended purposes, you are missing a lot of fun. What can you do with the Tester? Try a little neon lamp at low current. Another thought that comes right to mind is that perhaps it can be used in some way to check computer switching cores. I'm sure you can work up some new ideas. And as you puzzle them out you'll pick up a few pointers enabling you to make better use of this simple but surprisingly handy James Dandy Tester.

. . . W2DXH

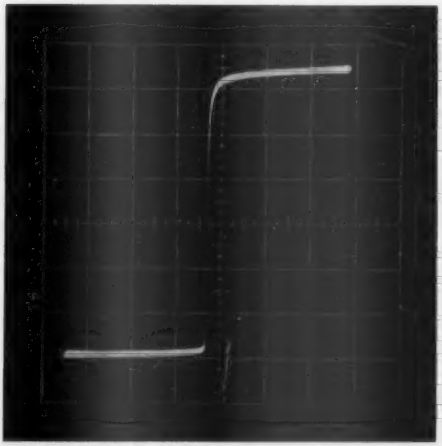


Fig. 11. BC reverse breakdown curve of an unknown computer-board germanium transistor. This one would make a good low-power zener.

John A. Attaway K4IIF
P.O. Box 205
Winter Haven, Fla. 33881

Some Commandments for DXing

Considering that the avalanche of DX activity has continued unabated through the worst of the past sunspot cycle, it seems logical to presume that the future months of increased sunspot activity will bring more and more "country-chasers" to the 80-10 meter bands. Therefore, in order to prescribe some measure of order in the impending chaos, it was decided to formulate a Ten Commandments of DXing. What finally emerged does not quite qualify for this dignified title, although there are ten rather broad rules, so it is offered to you simply as some commandments for DXing.

1. *Keep Up To Date*: When Gus, Don, Jose, or whoever is making the current DXpedition circuit, are on the road you've got to know about it, because if you miss the places they go it may be a long, long time before you get another chance. There are several good DX publications which furnish the latest possible information on who is going where, when, and what frequencies and modes to listen. Among the leading ones are Gus Browing's DXers Magazine (W4BPD), the West Gulf DX Bulletin (W5IGJ), Geoff Watts DX News-Sheet from England, and DX-Press (PAØLOU) from the Netherlands.

2. *Never Make More Than One QSO per Band per Mode*—with a DXpedition, or better yet on the very rare ones keep it to one QSO *PERIOD*. DXpeditions are usually staffed by good operators. If you work him you'll be in the log so there is no need to deprive others of a chance by making repeat contacts.

3. *Listen to Instructions*: If Don says, "Tuning up 5," then for crying out loud stay off his frequency, and if he says call again, "Only the station ending in item, foxtrot," then chances are it's my turn so give me a chance. If he says, "QRZ W7's only", then give the 7's a chance. Your turn will come.

4. *Watch Conditions*: If the rare one is S4 at your QTH, but is passing out 40 over 9 reports to some other call area then chances are you can shout your head off for an hour with a Texas kilowatt and get no results. However, when he is 40 over 9 at your place you can frequently work him with 50 watts.

5. *Keep Your Call's Short*: If you call W9WNV/HKØ three times and then sign your own call three times, Don will probably make four more contacts before you finish generating QRM on the frequency.

6. *Hear Him Before You Call Him*: You may hear W4DQH working YK1AA, but that doesn't mean you can copy Rasheed at your QTH. However, you can sure make QRM for the ones who do hear him.

7. *Don't Try to Ragchew With the Rare One*: Many rare DX stations enjoy a good ragchew and it's certainly their privilege. Nobody wants to give nothing but RST's to W,K's all day long, but if he is working them contest style let him. It's up to him to decide when to stop and shoot the bull for a while.

8. *Don't Tie Up the DX Station with Requests for an address;* he could be making three or four more contacts. There are plenty of ways to lnd out an address, try the Callbook, the QSL Manager's Directory, your DX Association bulletin, or the listings in QST and CQ.

9. *Avoid Long CQ Calls*: These are a symptom of lid-itis. Short CQs by new DXers with only a short list of countries confirmed are justifiable, but good DXers spend most of their time listening. For Petes sake don't be the fink who calls CQ DX in the

middle of a pileup. This is the crowning mark of the number one lunkhead.
and last but very, very far from least:

10. *Always Keep Your Logs in Greenwich Mean Time (GMT)*: When a QSL manager sits down to make out three or four thousand cards he doesn't have time to convert Lower Slobbovian Daylight Saving Time to GMT. If he did it would take him four times as long and your precious card would probably end up in File 13.

This is really not the end. This list could keep going, doubtless you have thought of a few that I have missed. Worthy of note also are: Don't Tailend, Don't break the SSB station on 14.110 with CW when he says no CW please (Argh!!!), Don't ask the rare one to stand by for your buddy when there is a big pileup calling him, etc.

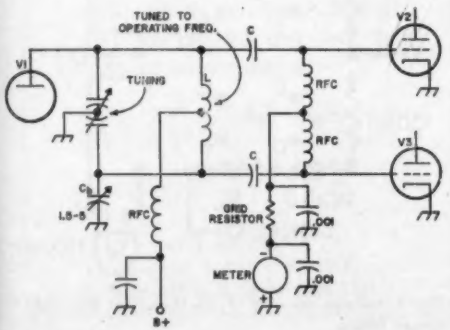
Happy DXing everybody. Really its a lot of fun.

. . . K4IIF

Capacitively-Coupled Phase Inverter

The most common phase inverter for rf is an inductively coupled transformer with the grid coil center tapped. However, at times it is difficult to use inductive coupling. The circuit shown is a method of phase inversion using capacitive coupling. Trimmer Cb is adjusted to approximately the output capacitance of V1 to balance the plate coil. Coupling capacitors C should be the same value. About 100 pF works fine on VHF and 500 pF on HF. On VHF the tuning capacitor should be a miniature butterfly. On the lower frequencies, a ganged tuning capacitor will work. I have had excellent results using this circuit.

. . . Larry Levy WA2INM



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Well, here's a small, solid-state indicator for both mark and space. It uses two #47 light bulbs, four resistors, four 2N697 transistors and two 1N270 diodes. The unit is smaller and lighter than a silver dollar. I etched a copper-clad board and mounted the works on it, but a peg board would work just as well. Take your choice. Connect up as in Fig. 1, which shows only one of the two channels. They are identical except that R_L may be different. This resistor will have to be closed emphierically. To adjust connect the completed unit to both the mark and space filters and to the power supply. Connect a 100 kΩ pot in place of each R_L and adjust for proper results on a received signal. The unit will trigger at approximately 0.02 mA and 3 V. I believe you will be very pleased with the operation of this unit, as I have.

. . . E. C. Sherrill K6JFP

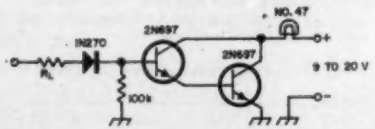

Fig. 1. Schematic diagram of one channel of the RTTY indicator.

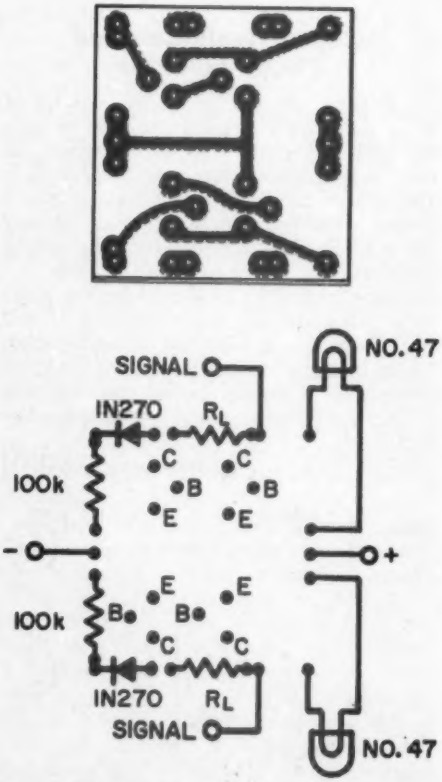

Fig. 2. Full-size drawing of the layout for the etched circuit board.

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Here is a 3½ inch speaker installed in an HW-12. The little brackets are glued on with epoxy cement to avoid drilling holes. The wires were fed through the gap between the chassis and the front panel. No parts had to be moved, and all components are still accessible. The sound comes out through the ventilating holes, and the speaker cannot be seen. Although many speakers can be used, one with a one-ounce magnet will be louder. It makes little difference if it is 3.2 ohm or 8 ohm.

Having the speaker in the set means one less cable to disconnect when moving the rig from house to car.

. . . Edward Romney WA1FTV

WWV on the Drake R-4A

Users of Drake R-4A receivers may receive WWV on 5 MHz without buying additional crystals or modifying the unit. Set the band switch to 3.5, the preselector to about 5.3 and switch on the calibrator. Tune in the calibration signal with the VFO dial reading between 630-635 and peak with the preselector. Switch off the calibrator and under proper conditions WWV can be received.

. . . Bob Fransen VE6TW

Reduction of Transformer Voltage

Here's a neat trick to reduce the high voltage output of a power transformer a small amount when used as a transmitting plate transformer. It's especially useful when an old TV transformer from the junk box is pressed into service with a silicon diode voltage doubler or full wave bridge, and the resulting dc output voltage is found to be just a little too high for comfort, as is frequently the case.

Simply wire one or more of the unused filament windings in series aiding with the 117 volt primary winding to obtain the effect of a few more turns in the primary. Various combinations are possible because the 5.0 volt rectifier filament winding can be used to subtract from a 6.3 volt winding if only a small reduction is desired. The current rating of the filament windings is no problem because they are usually wound from much heavier gauge wire than the primary itself.

Caution: Don't try the reverse of this trick; that is, *increasing* the output voltage of an inadequate transformer by wiring the filament windings in series opposing. The extra voltage which would result would saturate the core iron, resulting in increased hysteresis losses in the core and excessive heating of the transformer. The only exception would be to correct for a known low input voltage, but care must be exercised not to exceed the rated voltage of the transformer secondary in any case.

This trick has been used very successfully here at K8SCM and frequently spells the difference between using an old "junker" transformer in a critical power supply or shelling out a lot of bucks to buy that special-order job which will furnish the exact voltage the schematics call for.

. . . John Copeland K8SCM

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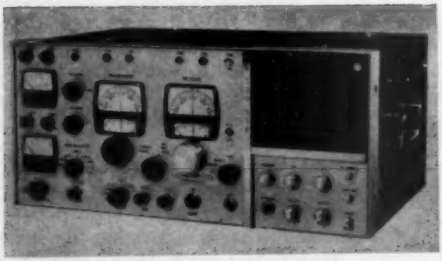
High Frequency Single Sideband Receivers, Transmitters And Transceivers

Jim Fisk WIDTY
Technical Editor



Babcock B-500-SSB Transceiver

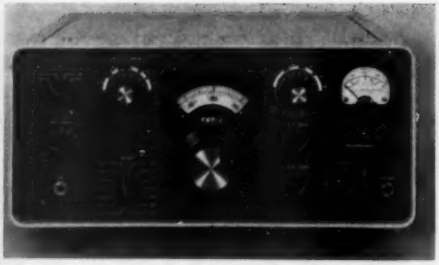
The new Babcock B-550-SSB is claimed to be the world's most advanced transceiver, utilizing techniques that significantly extend the state of the transceiver art. This completely self-contained unit uses the advantages of modular construction and provides high efficiency performance on SSB, CW and AM.

With the exception of the 12BY7A driver and 4CX250B final amplifier, all the circuits in the B-500-SSB use transistors or integrated circuits. A total of thirteen integrated circuits are used in conjunction with silicon transistors and diodes. The front end of the receiver uses two field effect transistors in cascode along with another FET in the first mixer. This combination results in a noise figure of 4 dB, sensitivity of at least 0.5 μV on all bands and crosstalk rejection on the order of 96 dB.

The B-500-SSB covers all the ham bands from 80 through 10 meters in eight 500 kHz segments. Two precision VFO's are built in, and each provides calibration at the 100 Hz points. The receive VFO permits independent receiver for working out of band DX stations.

The power input on all bands is 600 watts PEP on sideband, 250 watts on CW and 500 watts PEP on AM with the optional B-500-AM plate modulator. For maximum efficiency and linearity, the final 4CX250B is run in class AB_1 on single sideband and in class C for AM and CW. The optional AM modulator is a plug-in unit which mounts conveniently inside the transceiver cabinet.

Other interesting features of the new Babcock B-500-SSB are the built-in supplies for both 115 Vac and 12.6 Vdc, a front end noise blanker which uses its own broadband *if* amplifier and noise gate, notch filter with notch tuning and depth controls, a level control to eliminate external attenuators when using a linear amplifier, built-in SWR meter, and front panel selection of ALC. For more information on this brand new transceiver, write to L. E. Babcock and Company, 28 Durant Avenue, Maynard, Massachusetts 01754.



Collins KWM-2

The Collins KWM-2 maintains a reputation for outstanding performance in mobile and fixed station applications; in fact, many of these units are being used by the Special Forces in Viet Nam. The KWM-2 will run 175 watts PEP input on SSB or 160 watts on CW, with a nominal output of 100 watts on all bands from 80 through 10. Crystals are provided for complete coverage of all the high frequency ham bands except ten meters, where only one crystal is supplied. There is provision for mounting two more crystals to extend the coverage on the 28 MHz band.

The Collins KWM-2 was the first available amateur mobile SSB transceiver and features a filter type SSB generator with a mechanical filter, automatic load control for boosting average talk power, a *linear* permeability tuned VFO and one kHz calibration on all bands. Compactness and efficiency are achieved by having all tuned circuits and several tubes serve dual roles in transmitting and receiving. For MARS and military applications, the KWM-2A is available. This unit has an additional crystal board which enables the operator to add 14 crystals to cover frequencies outside the amateur bands.

There is a complete line of accessories available for the KWM-2, including the 312B-4 speaker console which has a built in phone patch and directional wattmeter, the 516F-2 AC power supply, the PM-2 lightweight portable power supply, the MP-1 mobile power supply, the 351D-2 mobile mount, the very effective 136B-2 noise blanker and the 399B novice adapter. This latter accessory permits crystal control of the transmit frequency for novice operation.

Collins 75S-3B Receiver

The Collins 75S-3B is a very versatile receiver with exceptionally sharp selectivity and operation on either SSB, CW, or RTTY. AM is also provided and the passband can be optimized by the installation of an optional 3.1, 4.0 or 6.0 kHz mechanical filter. In addition, two CW positions offer up to three degrees of selectivity in the CW/SSB mode with optional plug-in filters.

The 75S-3B can be combined with the 32S-3B transmitter to make a completely integrated station. When used with the 32S-3B, this receiver is capable of transceiver-type operation with the receiver VFO controlling the transmitting frequency. Coverage outside the amateur bands or additional 10 meter band coverage is obtained by plugging in the appropriate crystals.

Also available is the 75S-3C which provides extended frequency coverage. It is identical to the 3B except that an additional high frequency crystal board and front panel selector switch are included.

Collins 32S-3B Transmitter

The highly flexible 32S-3B transmitter covers all the amateur bands between 3.5 and 30 MHz with a power input of 175 watts PEP on SSB or 160 watts on CW. The nominal output on all bands is 100 watts. In the 32S-3B, the design engineers have

produced a transmitter with a minimum number of controls for precise tuning and maximum operational efficiency.

The 32S-3B is equipped with crystals for covering eleven 200 kHz bands to cover the ham bands from 3.5 to 30 MHz. Two additional positions are provided for extended coverage of the ten meter band and a third position may be used to cover an additional 200 kHz band in the 9.5 to 15 MHz range.

For CW use, grid block keying is used with adjustment of the characteristic from "soft" to "hard" to suit the individual operator. The 32S-3B may also be adapted to RTTY operation because of the high stability of the unit.

The Collins 32S-3B uses dual conversion with a linear permeability tuned VFO which offers the utmost in stability. The VFO may be used to control the transmit frequency, or when used with the companion 75S-3B receiver, to control the receive frequency. For improved linearity and reduction in distortion products, rf inverse feedback is used along with an automatic load control for higher average talk power.

Drake TR-4

The Drake TR-4 transceiver is engineered for optimum performance on upper or lower sideband, AM and CW. It is compact and lightweight, and is ideal for limited space, for mobile, for vacations or for portable excursions and DXpeditions. With 300 watts PEP input, it will give a good account of itself barefoot or will drive higher power ham linears. The RV-4 receiving VFO solves the problem of working DX and other stations operating on frequencies other than your transmitting frequency.

The TR-4 covers all the amateur frequencies between 3.5 and 30 MHz without the requirement of accessory crystals. In addition, either upper or lower sideband may be used on all bands with full VOX or PTT on both SSB and AM. For CW operation there is provision for automatic transmit and receive switching for semi break-in operation. A built-in CW sidetone oscillator provides monitoring of your CW signal.

The receiver exhibits a sensitivity of less than 0.5 μV for 10 dB signal to noise and provides full AVC on all modes; the audio output varies less than 3 dB for 60 dB change in signal level.

The sideband generator of the TR-4 uses two special 9 MHz crystal filters to provide upper and lower sideband selection on any band without the necessity of shifting oscillators. The filters are designed so that they are steeper on the carrier side, making sideband suppression of 40 dB and carrier suppression of 50 dB possible. For AM operation a controlled carrier AM screen modulator is built-in; the controlled carrier mode is compatible with SSB linear amplifiers.

On CW the power input is 260 watts and the carrier is shifted approximately 1000 Hz into one sideband. In the CW mode grid block keying is used to key the mixer and driver stages.

For operation from the 115 volt AC line the AC-4 power supply supplies all the necessary voltages. For mobile operation, the MMK-3 mobile mounting kit and 12 volt DC-3 DC power supply are available. For the deluxe installation, an MS-4 matching speaker may be used; this unit has space for mounting the AC-4 power supply in the rear.

Drake R-4A Receiver

The Drake R-4A receiver is a complete ham band receiver that covers all the frequencies on 80 through 15 meters and one 500 kHz segment of our ten meter band

between 28.5 and 29.0 MHz. For additional coverage on ten meters or on other 500 kHz segments between 1.5 and 30 MHz, accessory crystals are available.

The R-4A features a tunable passband filter that provides selectable bandwidths of 0.4, 1.2, 2.4, and 4.8 kHz at 6 dB down. At 60 dB down the bandwidths are 2.6, 4.8, 8.2 and 25 kHz respectively. The sensitivity of this receiver is less than 0.5 μV for 10 dB signal plus noise to noise and the AVC provides less than 3 dB change in audio with a 60 dB change in rf at the front end. In addition, the R-4A has excellent overload and cross modulation characteristics and is quite insensitive to the operation of nearby transmitters.

The Drake R-4A works on all modes, SSB, AM, CW and RTTY, with full rf gain, complete AVC action and accurate S-meter indication. Both the notch filter and 100 kHz calibrator are built in, and an excellent noise blanker provides excellent results on SSB, AM and CW.

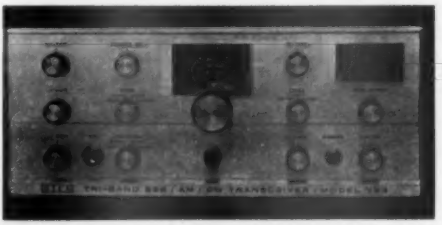
The image rejection of the R-4A is greater than 60 dB and the internal spurious responses are less than the equivalent 1 μV signal on the antenna. Also, *if* rejection is more than 60 dB. The combination of low spurious and image response along with excellent sensitivity and selectivity add up to an excellent receiver for amateur use.

Drake T-4X Transmitter

The Drake T-4X is a complete sideband transmitter which may be used with the Drake R-4A for complete transceiver operation. The T-4X covers the ham bands from 80 to 10 meters with one crystal provided for ten meter operation from 28.5 to 29.0 MHz. Four additional accessory sockets are provided for complete coverage on ten meters or for four 500 kHz bands between 1.8 and 30 MHz. The VFO is a linear permeability tuned solid-state unit which is calibrated at the 1 kHz points on all bands.

The use of double tuned circuits and two special crystal lattice filters result in carrier suppression of 60 dB and unwanted sideband suppression of at least 40 dB above 750 Hz. In addition, the average distortion products are in excess of 30 dB down. The input power of the T-4X is 200 watts PEP on SSB and AM and 200 watts on CW. In the CW mode grid block keying is used and the built-in VOX circuit is keyed for automatic transmit-receive switching for break-in operation. For RTTY operation, the VFO is easily adaptable to FSK. The signal frequency shifts the same direction and the same amount on all bands with a given dial setting.

The T-4 Reciter (receiver-controlled exciter) is similar in all aspects to the T-4X transmitter except that it does not have a built in VFO. When used with the R-4A, the T-4 provides completes transceive operation.



EICO 753

Although the modern sideband transceiver is a very complicated piece of equipment, it is not at all difficult to assemble the EICO 753 sideband transceiver kit. This transceiver has both PTT and VOX and the offset tuning allows you to move the receiver up to 10 kHz away from the transmit frequency. The engineering of this transceiver leaves little to be desired, and the step-by-step instructions are clear and easy to follow. At a time when so much amateur equipment is being bought factory wired, the ham who constructs his own from a kit can feel well satisfied.

The full-band coverage of the 753 actually goes beyond the band edges: 3490 to 4010 kHz, 6990 to 7310 kHz and 13890 to 14410 kHz with lower sideband on 40 and 80 and upper sideband on 20. The VFO is completely solid state and is very stable for either

fixed or mobile operation. Complete VOX is built in with the VOX threshold, delay, sensitivity and anti-VOX controls available on the rear deck.

The power output, 120 watts PEP, is sufficient to drive any linear amplifier, and when used barefoot will give an excellent account of itself. The high level dynamic ALC circuitry controls splattering and flat-topping as well as linear amplifier loading. For the ham who doesn't want to roll his own, EICO has conveniently made a factory assembled version available for $299.95.

Galaxy V Mark 2

The new Galaxy V Mark 2 transceiver maintains all of the features of the old model, but adds some new things to make a very nice package better. This new transceiver is rated at 400 watts PEP in SSB service, up 100 watts from the old model, has a new precise vernier logging scale that lets you interpolate accurately down to 50 Hz or so, a solid state VFO for improved frequency stability and drift and a built-in audio sidetone for the CW boys. In addition, there is a new CW filter and break-in option available if you want the maximum in CW operating convenience.

The excellent sensitivity of the Galaxy V, less that 0.5 μV for 10 dB signal to noise ratio, and the extremely good shape factor of the *if* passband provide very good results on our crowded bands. The dual attack and release AVC make the receiver virtually block proof. For increased power and minimum flat-topping and distortion, the internal ALC circuit provides up to 10 dB of compression.

This unit is lightweight and compact, and is an ideal choice for mobile operation. For mobile use, the G35A DC supply furnishes all the necessary voltages; for fixed station use, the AC35 AC power supply is available. Other accessories which are available are a remote VFO for working stations off your transmit frequency, a deluxe accessory console which has a built-in speaker, phone patch, SWR bridge and 24 hour digital clock, a speaker console which has provision for mounting the AC power supply, and several accessories for mounting the Galaxy V Mark 2 in your car.

Hallicrafters SR-500 Tornado

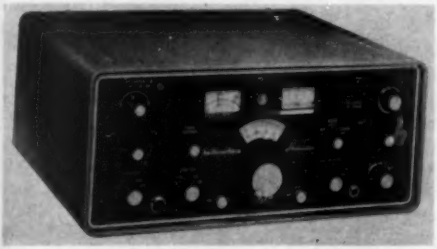
The Hallicrafters SR-500 Tornado transceiver provides the amateur with high-performance SSB and CW operation on the three most popular ham bands; 80, 40 and 20 meters. Lower sideband is used on 80 and 40 meters and upper sideband on 20. The 500 watts PEP input of this transceiver provides an excellent account of itself when run "barefoot."

The transceiver incorporates Hallicrafters' exclusive Amplified Automatic Level Control (AALC) to prevent splatter and final amplifier flat-topping. In addition, the receiver section contains Receiver Incremental Tuning Control (RIT) which allows the operator to tune the receiver up to 3 kHz to either side of the transmitter frequency. All jacks and switching for linear amplifier operation are included as well as a combination S-meter/RF output indicator.

The dial is calibrated in 5 kHz increments, and these are accurate to within 2 kHz between the 100 kHz points when used with an optional crystal calibrator. The stability of the VFO is excellent, and is stable to within 300 Hz after warmup.

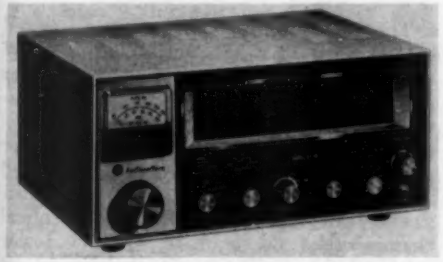
Accessories available for the SR-500 include the HA-16 VOX adapter, the P-500 AC power supply for fixed station operation

and a P-500 DC power supply for mobile operation from a 12.6 volt DC power source. For mobile installations the special MR-160 mobile kit is available which includes all the inter-connecting cables.



Hallicrafters SR-2000 Hurricane

The Hallicrafters SR-2000 Hurricane may well be the world's most powerful transceiver—it runs a full 2000 watts PEP input on single sideband. This transceiver has many interesting features in addition to its full legal power rating. A linear gear driven VFO is provided which has less than 1 kHz readout; receiver incremental tuning for working stations off the transmit frequency, built-in amplified automatic level control (AALC), built-in VOX plus CW break-in and PTT. The use of double tuned circuits and steep sided crystal filters results in improved spurious signal rejection and carrier suppression of 50 dB, unwanted sideband suppression of 50 dB and 30 dB suppression of the 3rd and 5th distortion products.



Hallicrafters HT-46

The Hallicrafters HT-46 SSB/CW transmitter provides a potent input power of 175 watts PEP on SSB and 150 watts on CW. It is outstanding as a separate transmitter with a self contained AC power supply, but its extra versatility is shown by the transceiving capability provided for use with the matching SX-146 receiver. In addition, it may be operated separately from its own internal VFO. Physically it is the same size and appearance as the SX-146 receiver, so it makes an ideal companion to it.

The HT-46 transmitter features advanced crystal filter sideband generation at 9 MHz and selectable sideband operation on all bands. Although only 500 kHz of the ten meter band is provided, accessory crystals are available to cover the complete ten meter band. For use on CW, the grid block keying circuit provides exceptional keying qualities.

Hallicrafters SX-146

The Hallicrafters SX-146 receiver features an advanced design which employs single conversion to a high frequency crystal filter for selectivity. A premixed oscillator chain assures a high order of frequency stability and minimizes adjacent channel cross modulation products. This receiver is supplied with crystals for all the ham bands from 80 to 15 with a 500 kHz segment on ten meters, but the connection of auxiliary oscillators will permit its use from 2 to 30 MHz, except for a small region around 9 MHz, the frequency of the crystal filter. Crystals are available from the manufacturer for complete coverage of the ten meter band.

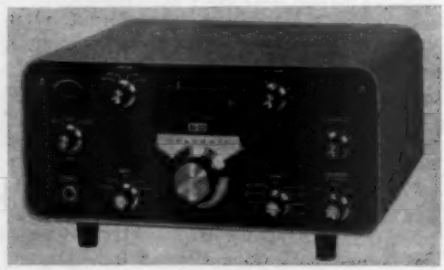
The selectivity of this receiver as supplied by the factory is 2.1 kHz at the 6 dB points, but optional filters 0.5 kHz and 5.0 kHz wide are available for CW, RTTY and AM operation. The SX-146 provides selectable sideband, a very effective noise limiter and good sensitivity. For transceiver operation, the SX-146 may be used in conjunction with the Hallicrafters HT-46 5 band transmitter.

Heathkit SB-401 SSB Transmitter

The Heathkit SB-401 SSB transmitter may be used with the SB-301 receiver for full transceive operation or it may be used independently. The SB-series combination goes from transceive operation to independent transmitter-receiver operation with a flip of a single switch on the SB-401 front panel.

The SB-401 transmitter employs compactron tubes for space-saving component layout, and heavy-duty circuit board construction plus precut wiring harness permits fast assembly and assures stable operating characteristics. For maximum protection from TV interference, all the circuits are completely shielded and isolated.

The VFO in the SB-401 is the same type of linear master oscillator used in the SB-301 receiver. In addition, the SB-401 features built-in ALC, antenna changeover relay, upper or lower sideband selection, 1 kHz dial calibration and full coverage of the amateur bands from 3.5 to 30 MHz.



Heathkit SB-301 Receiver

The new Heathkit SB-301 raises the standards for amateur band receivers and brings full RTTY reception capability to the SB-series plus full coverage of the amateur bands from 80 through 10 meters. In addition, a 15 to 15.5 MHz tuning range enables the most accurate attainable frequency checks with WWV. The outstanding noise limiter used in the SB-301 provides impulse noise rejection for the receiver and signals in high noise locations are easily readable.

Other features of the SB-301 are the prebuilt linear master oscillator (LMO) which provides receiver tuning with bandspread equivalent to 10 feet per MHz. In addition, it is linear over the entire receiver coverage.

When used with the SB-401 SSB transmitter, the SB-301 provides full transceive operation. The high sensitivity of this receiver, less than 0.3 μV for 10 dB signal-plus-noise to noise, plus the selectivity of 2.1 kHz provide excellent performance. For the RTTY and CW operator, optional crystal filters are available which provide selectivity of 3.75 kHz and 400 Hz respectively at 6 dB down.

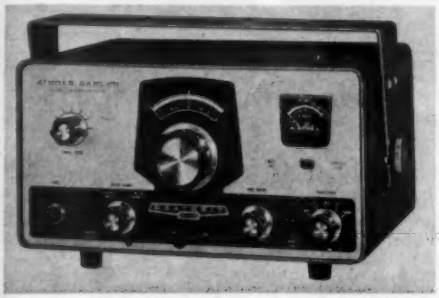
Heathkit SB-100 Transceiver

The Heathkit SB-100 transceiver is rated at 180 watts PEP SSB and 170 watts CW with full coverage of the fine ham bands below 30 MHz. The sideband generation circuitry of the SB-100 features a six pole crystal lattice filter which produces a superior 2:1 shape factor and symmetrical passband which results in sharper receiver tuning, greater sideband suppression, and identical characteristics on both upper and lower sideband signals. The carrier is down 50 dB from single tone output, the unwanted sideband is suppressed more than 55 dB and the third order distortion products are 30 dB down.

The new Triple Action Level Control (TALC) uses three separate circuits to provide greater speech compression; is service

the TALC circuit results in 10 dB of speech compression with 0.1 mA final grid current. The use of a linear master oscillator (LMO) provides linear and smooth tuning with 1 kHz calibration on all bands. Both VOX and PTT are built into the SB-100 as well as semi break-in operation for CW; a CW sidetone is also provided.

For operation at a fixed station, the 115 volt HP-23 AC power supply is available. For mobile installations, the HP-13 DC power supply and SBA-100-1 Mobile Mounting Kit will make things easy.

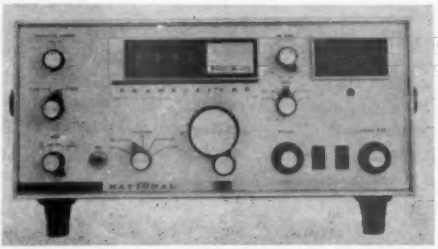


Heathkit 12A, 22A, and 32A Single-Band Transceivers

These new versions of the SSB transceiver that opened up a whole new era in amateur radio have several interesting features. Heath has gone all out to give the radio amateur greater economy and better performance in their famous single-banders. Foremost among the new features of this series is the selectable upper or lower sideband.

In addition the microphone input and gain control, plus bias adjustments are now located on the front panel for ease in changing from fixed station to mobile operation. An added function switch position controls the optional 100 kHz crystal calibrator and the power connectors are now fully compatible with the Heath SB-series power supplies.

The receivers in these new units feature 1 μV sensitivity for 15 dB signal-plus-noise to noise ratio and 2.7 kHz selectivity. The modern crystal filter provides more than 45 dB of carrier and unwanted sideband suppression and the slow AVC action provides optimum SSB reception.



National NCX-5 Mark II

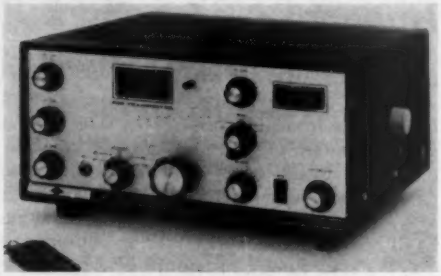
The National NCX-5 Mark II transceiver features 200 watts PEP on sideband, 200 watts CW and 100 watts AM on the popular ham bands from 3.5 to 30 MHz. The 1 kHz dial calibration is accomplished with a technique previously used only in the most expensive laboratory or military equipment—a digital readout in kHz on each amateur band with additional counter calibration to 100 Hz. The tuning rate of 10 kHz per knob revolution is identical on all bands and parallax is zero.

The NCX-5 is a double conversion unit with crystal controlled high frequency oscillators on each band and a *linear* solid state VFO. The use of a transistorized VFO eliminates many of the thermal instabilities of vacuum tubes and provides stability from a cold start which is equivelant to that of the best tube-type oscillators after warm-up.

The excellent selectivity characteristics of the NCX-5 are obtained through the use of an eight pole crystal lattice filter. This filter has a shape characteristic of 1.7:1 and 60 dB down the passband is only 4.76 kHz wide; at the 6 dB points the passband of 2.8 kHz uses a minimum of spectrum consistent with pleasing voice quality. With the crystal filter and balanced modulator used in the NCX-5, the carrier suppression is 50 dB, the unwanted sideband suppression is 50 dB and third order distortion products are 30 dB down.

The NCX-5 incorporates selectable sidebands on all ham bands along with transceiver vernier tuning to permit 5 kHz tuning of the receiver independently from the transmitter. For DX operation, the optional VX-501 digital dial VFO is available. The NCX-5 may be operated either with VOX or PTT on both AM or SSB or with grid-block semi-break-in keying on CW. For AM operation a separate AM detector and AM carrier insertion is provided.

The National NCX-5 incorporates two rf stages in the receiver section for increased sensitivity and spurious signal rejection, and the fast attack, slow release AVC system provides smooth, clean SSB/CW reception without distortion, clicks, pops or thumps. For the deluxe installation, oiled walnut cabinets are available for the NCX-5, the VX-501 external VFO and the NCX-A AC power supply.



National 200

The new National 200 transceiver gives the radio amateur complete SSB, AM and CW coverage of 80 through 15 and 600 kHz between 28.5 and 29.1 MHz on ten meters at a very reasonable price. For complete coverage of the 10 meter band two additional crystals may be obtained from the National Radio Company. This new transceiver features 200 watt PEP input on all bands. The fast attack, slow release AVC system works on all modes, SSB, CW and AM. For optimum performance, separate product detector and AM detection circuits are used.

To maintain high stability and the same tuning rate on all bands, a premixed crystal controlled front end arrangement is used. The selectivity obtained from the crystal lattice filter is excellent and results in a shape factor of 2.2:1 for high sideband suppression on transmit and rejection of adjacent channel QRM on receive. The solid state balanced modulator used in the National 200 results in more than 50 db of carrier suppression. Third order distortion products are suppressed more than 30 dB at full output and the unwanted sideband is suppressed 40 dB.

The extremely smooth tuning mechanism uses a 45:1 planetary and split gear drive; the dial is calibrated every 5 kHz. For AM and CW operation, the carrier is automatically inserted when switching to these modes. For maximum talk power on SSB and AM, an internal ALC circuit is provided; an external ALC input is available for use with higher power linear amplifiers.

Sideband Engineers SB-34

The SB-34 transceiver is a complete four band transceiver for 80, 40, 20 and 15 meters, with built-in power supplies for both 115 volts AC and 12 volts DC. The SB-34 is almost completely transistorized with 23 transistors and 20 diodes; the only vacuum tubes used are in the final power amplifier and driver stages. In addition to the built-in power supplies, all the necessary inter-connecting cables are provided with each unit. Since a front panel mounted speaker is included, only a suitable antenna and a microphone are required to put the SB-34 on the air.

This transceiver uses a Collins 2.1 kHz mechanical filter for excellent receiver selectivity and a sharp, clean sideband signal. There are no relays inside the SB-34; all the transmit-receive switching is accomplished with solid state circuitry. The VFO tuning dial employs a dual speed mechanism which allows fast dial movement to the desired portion of the band and smooth slow speed drive for positive vernier tuning of a single sideband signal. The sidebands are completely selectable from the front panel and a offset tuning control allows the receiver to be tuned up to 2 kHz from the transmitting frequency.

On DC operation the transmitter filaments may be switched off with a front panel switch for low current operation of the receiver portion. This type of operation is especially desirable for portable or emergency operating conditions; the transceiver only requires 500 mA at 12 volts DC in this stand-by-receive mode.

Swan 350 and 400

The Swan 350 transceiver is a complete coverage 5-band unit providing SSB, AM and CW; its companion is the Swan 400. The 350, with an appropriate power supply is a complete package requiring only a microphone and an antenna; the 400 requires an external VFO in addition to a power supply, microphone and antenna. The 350 was designed to be a basic transceiver, providing the means for the owner to add the accessories of his own choice.

Accessories available for the Swan 350 include a 100 kHz calibrator, selectable sideband kit, and transistorized VOX. On the other hand, the Swan 400 includes the calibrator, selectable sideband, built-in speaker and VOX but does not include the VFO. There is a choice of three different VFO's for the model 400, the model 410 which is essentially the same as the VFO used in the 350, the MARS oscillator which provides operation on any crystal controlled frequency between 3 and 30 MHz and the mobile model 406B VFO. The 406B is actually a combination control box and VFO and when used with the Swan 400 permits remote control of a trunk mounted transceiver in your car. It includes the VFO as well as an rf gain control, microphone jack and bandswitching. Any one of these VFO's may be used with the Swan 350 to provide transmit-receive functions on different frequencies.

The power supplies available for the Swan transceiver are also quite extensive. The standard AC supply, the model 117XC is probably the most popular supply, because it is a very husky unit that may be used mobile with the proper Swan conversion kit. For negative grounded cars (12 volt) the model 14X kit is required; for positive grounded cars, the model 14XP is used. These conversion kits are simply modules which plug into the back of the standard 117XC power supply. For the operator who wants to operate mobile only, Swan also has a DC power supply available, the model 14-117.

Recent Transceiver and Linear Amplifier Reviews

"The Drake R-4 Receiver", WA2TDR, 73, January 1966, page 78.
"Drake L-4 Linear", W1DTY, 73, February 1967, page 90.
"The EICO 753K", W3KET, 73, January 1966, page 76.
"Galaxy V", W2NSD, 73, April 1965, page 78.
"Heathkit SB-100", K2EQB, 73, August 1966, page 50.
"The Heath SB-200", WA2TDH, 73, January 1965, page 78.
"The Heathkit SB-300 Receiver," WA2TDH, 73, August 1964, page 66.
"The Heath SB-400", K1RPB, 73, September 1964, page 64 and October 1964, page 91.
"Heath HW-22 SSB Transceiver", WA2TDH, 73, January 1964, page 74.
"The Little Bomb", (Heath HA-14 KW Kompact), WB6KEH, 73, October 1965, page 88.
"Henry 2-K Linear", W2NSD/1, 73, June 1965, page 28.
"National 200", W1DTY, 73, February 1967, page 104.
"NCX-3 by National", W2NSD/1, 73, April 1963, page 78.
"National NCX-5", W5DWT, 73, October 1965, page 84.
"National NCL-2000", W1ALU, 73, October 1964, page 92.
"The SB-34", W8QUR, 73, August 1965, page 68.
"Swan 350", WB6DEH, 73, February 1965, page 82.
"Transcom SBT-3 Transceiver", W2NSD/1, 73, November 1965, page 86.
"WRL Duo-Bander 84", W8QUR, 73, October 1966, page 74.

High Frequency Single Side Band Linear Amplifiers

BTI LK-2000

The BTI LK-2000 is a single tube, grounded grid linear amplifier built to really take it and loafs along at the full legal input. This amplifier is offered in two styles—the floor model console, or the two-unit table top model with a separate power supply. Either model is convertible into the other with a few available conversion parts.

The amplifier tube is the quick-heating Eimac 3-1000Z which has a full 1000 watts plate dissipation and replacement cost of only seventy-eight dollars. More than adequate cooling is provided by using the recommended air cooled socket and chimney along with a very quiet blower. A unique after cooling feature has been incorporated in the BTI LK-2000 which keeps the blower running from 60 to 90 seconds after the amplifier is turned off.

The solid state power supply is built around a husky 40 pound plate transformer; computer grade capacitors provide 30 uF of output capacitance. The combination of a solid state power supply and quick-heat-tube permit almost instant on and off—no warm-up waiting is required. For filament power to the 3-1000Z, a separate filament transformer is mounted in the rf section.

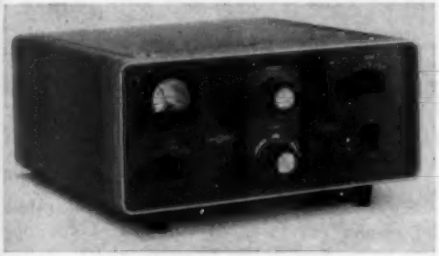
Drive to the 3-1000Z is applied through low-Q broad band tuned input circuits; not over 100 watts of drive is required for full power operation. The LK-2000 performs quite well with only 50 watts of drive and under these condition provides 1500 watts PEP input. Although the cathode input circuits are tuned for amateur band phone operation, they may be retuned by the user for operation at other frequencies with the instructions furnished.

A pi-L output circuit is used to match the plate to the antenna; the pi-L is preferred over the simple pi circuit because of its improved harmonic attenuation. To assure maximum shielding, all cabinet joints of the rf section are alumi-gold processed.

The ALC circuitry used in the BTI LK-2000 provides many distinct advantages; when adjusted according to the instruction manual, the ALC will prevent distortion from overdriving in either the amplifier *or* the exciter. It allows much freedom in mouth-to-mike distance while maintaining the same full output. Even when you get a little excited and shout, the ALC instantly adjusts the level to prevent distortion.

Either 115 or 230 volts is required for the power supply. An overload relay in the

plate current circuit turns off the main power relay when plate current exceeds one ampere. An accessory dummy load is available which will take the full output of the transmitter for several minutes during tune up. A control knob on the front panel of the amplifier switches from the antenna to the dummy load; a thermal switch in the load will automatically turn off the amplifier if the load reaches it maximum rated temperature.



Collins 30L-1

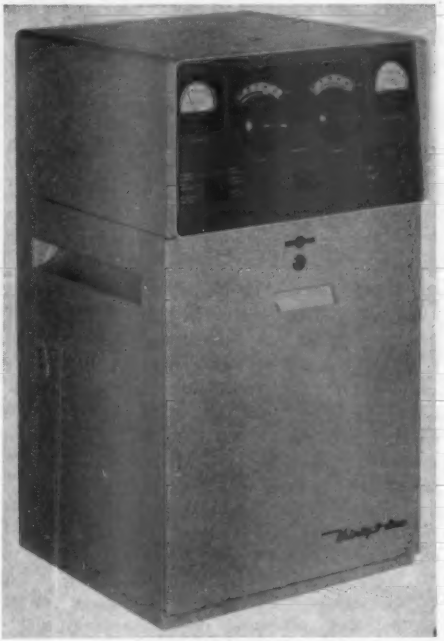
The Collins 30L-1 linear amplifier is rated at 1000 watts PEP on SSB and 1000 watts average on CW on all bands; it may be easily driven to its fulled rated input by any 70 to 100 watt exciters. This unit is completely self contained and designed for table top use.

Although the 30L-1 was designed specifically for SSB and CW service on the amateur bands from 3.5 to 30 MHz, provisions are made for general coverage use too. The ALC voltage from the 30L-1 linear is fed back to the exciter, providing maximum talking power without overdriving and distortion. In combination with rf inverse feedback, the ALC circuit provides more average power with a sharper sounding signal.

The 30L-1 uses four 811A triodes in the grounded grid configuration. Since the 811A's are instantly heated, there is no delay in warm-up.

In addition to indicating plate current and plate voltage, the panel meter is connected into a special comparator circuit. In the "tune" position, the amplifier is optimumly tuned when the tuning and loading controls are adjusted to zero the meter.

For safety, both the rf and power supply compartment covers operate safety interlock switches. Cover removal closes these switches and shorts the high voltage to ground. This arrangement protects the operator from accidentally coming in contact with the high voltage dc which is present in both compartments.



Collins 30S-1

The Collins 30S-1 requires only 70 to 100 watts of driving power to provide the full legal input of 1000 watts (average) on SSB and 1 kW on CW transmissions. This amplifier is completely self-contained and uses the commercially popular 4CX1000A as a grounded grid linear amplifier.

All the controls for operating the 30S-1 are conveniently located on the front panel permitting fast and efficient band changes. With the simple push of a button you can switch from the 100 watt power level of your exciter to the full kilowatt output of the 30S-1.

To assure maximum talking power and minimum distortion, the ALC voltage from the 30S-1 is fed back to the exciter. This, incombination with rf inverse feedback, provides a very clean and sharp signal. Correct tuning and loading are indicated by a zero reading on a full scale multimeter; the loading control and PA tuning control are simply adjusted to obtain zero meter indication.

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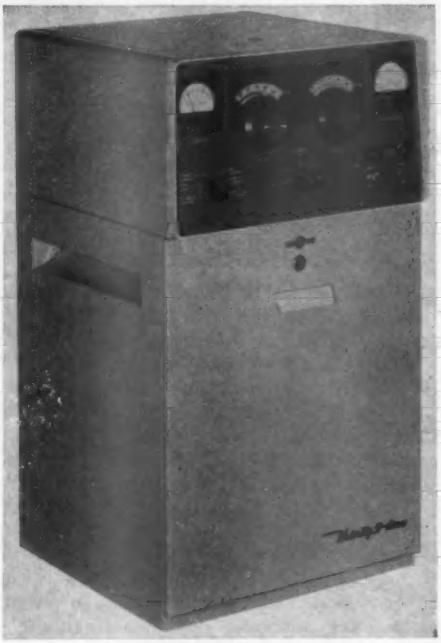

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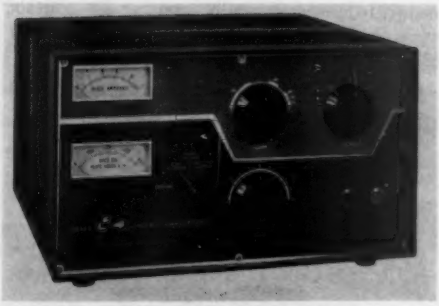


Drake L-4

There's nothing halfway about the Drake L-4 linear amplifier; this unit is built for continuous duty at full capacity. The rating of 2000 watts PEP on SSB and 1000 watts on CW, AM or RTTY is ensured; the massive plate transformer, heavy duty tank components and voluminous cooling system make continuous operation at these ratings possible.

The power amplifier uses two 3-400Z or 8163 zero bias triodes in a class B grounded grid circuit. These two tubes have a total plate dissipation of 800 watts and their rugged construction will withstand a lot of abuse. For minimum distortion, higher efficiency and a constant 50 ohm input impedance, the cathodes of the 3-400Z's are matched with broadband tuned input circuits.

Any exciter that will deliver 100 watts PEP SSB and 75 watts on CW will drive the L-4 to the maximum legal input power. In the grounded grid configuration, most of the driving power is added to the output power. The use of a transmitting AGC circuit controls the exciter gain to allow a higher audio level without peak clipping. In addition, rf feedback is used to decrease distortion to better than 35 dB and tends to equalize tube characteristics from tube to tube.

Galaxy 2000

The unique new design of the Galaxy 2000 permits the use of ten parallel 6HF5 tubes to deliver high efficiency, even on ten meters. In fact, the power output on all bands is guaranteed to be at least 1200 watts PEP. These tubes are easily obtainable and their total replacement cost makes them very attractive for linear amplifier use. In the Galaxy 2000 the 6HF5's operate well within the manufacturer's voltage, current and temperature specifications.

The Galaxy 2000 operates in class AB$_1$ and delivers a very clean and stable signal. The amplifier incorporates both voltage and current monitoring, with an FCC specified time constant meter, as well as a tune position which monitors the rf output of the amplifier. The automatic linearity system (ALS) circuit used in the Galaxy 2000 provides automatic comparison of the input-output waveform, and acts on this information to maintain exact waveform duplication with best linearity.

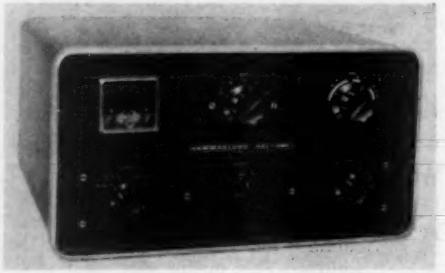
The Galaxy 2000 features a compact table top design with built-in antenna changeover relay, heavy duty solid state power supply, and reduced power input in the tune-up position. Any exciter in the 100 to 200 watt class will drive the amplifier to full rated input and only a single ground of the operating control circuit is required for operation.

Gonset GSB 201

Exceptionally compact—only 8½" high, 12¾" wide and 17" deep—the GSB-201 lends itself readily to table-top mounting. Finished in blending light greys, it presents a handsome, clean-cut appearance.

The Gonset GSB linear amplifier provides 10 dB gain on the 80, 40, 20, 15, and 10 meter bands with maximum input power of 2000 watts PEP on SSB, 1000 watts CW or 400 watts AM. It will operate with nearly any SSB exciter, homebrew or commercial; 100 watts PEP drive will provide the maximum of 1000 watts PEP output. The GSB 201 incorporates a number of desirable operating features which include the use of four low cost 811A tubes in stable, grounded grid circuitry. The power supply uses mod-

ern silicon rectifiers and an antenna changeover relay is built in. A panel switch permits preliminary tuning to be done at low power levels, thereby reducing interference. The plate current meter is switchable from the front panel to indicate plate current or relative power output.



Hammarlund HXL-1

The Hammarlund HXL-1 1500 watt PEP linear amplifier provides an excellent match to lower powered SSB exciters and provides 1500 watts PEP on SSB, 1000 watts on CW and 250 watts in AM service. This efficient linear uses a pair of 572A/B triodes in a bandswitching arrangement that covers all the ham bands from 80 through 10 meters. This amplifier features an internal power supply, built-in antenna changeover relay, pi net output circuit and a multipurpose meter which has been provided with a built-in circuit that even provides a linearity test.

Heath KW Kompact

Interested in a kilowatt mobile? How about a small table top linear? The Heathkit HA-14 KW Kompact may be just what you're looking for. This miniscule little box will provide up to 1000 watts PEP on all bands from 80 through 10, yet is only 3 3/16 inches high, a little over a foot wide and ten inches deep. It is small enough to be mounted under the dash of nearly any car with plenty of room to spare-room enough in most cars to allow it to be stacked with your transceiver, providing a complete under-the-dash mobile kilowatt station.

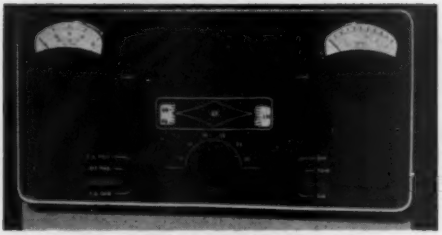
Two 572-B/T-160-L's operating in parallel in the final provide a clean signal with third order distortion products 30 dB down at 1000 watts PEP input. A built-in SWR meter and antenna changeover relay add to the operating convenience. In addition, the broad band input circuits on each band require no tuning. Also, provisions for remotely controlling the power supply used with the KW Kompact should appeal particularly to the mobile operator.

Heathkit SB-200

The Heathkit SB-200 desk-top linear amplifier is a complete self-contained unit that provides 1200 watts PEP input on SSB and 1000 watts on CW. This unit has its own built-in power supply and any exciter with 100 watts PEP output will provide adequate drive. Two heavy-duty 572-B/T-160-L final amplifier tubes provide an extremely clean signal with minimum distortion.

For maximum efficiency and low distortion, pretuned cathode input circuits are used. These, along with ALC within the SB-200 and provision for external use of the automatic level control result in a relatively constant audio output under varying conditions. The amplifier is completely shielded for TVI protection and stability and a built-in SWR meter and antenna changeover relay provide the maximum in operating convenience.

The conservatively rated power supply uses silicon diodes for maximum reliability and is circuit breaker protected (no fuses to worry about). In addition, this supply may be operated from either 115 or 230 volts ac, 50/60 Hz.



Henry 2-K

The Henry 2-K linear amplifier uses two rugged 3-400Z grounded grid triodes which were especially designed for zero-bias linear operation. These tubes provide 800 watts of plate dissipation and the full legal limit in all modes—2000 watts PEP on SSB and 1000 watts on CW, AM, and FSK.

The Henry 2000 watt linears are available in two models, the console model 2K-2 and the desk model 2KD-2 which has an external power supply. If you have your own power supply, the rf deck is available separately as the 2KR-2. The power supply used in these units is a heavy duty 2500 volt dc supply which is rated very conservatively. A choke input filter provides very good regulation and the solid state rectifiers insure year-in, year-out reliability.

For greatest efficiency and maximum attenuation of unwanted signals the pi-L plate circuit uses a silver plated tank coil. The band switch is a rugged unit with 20 ampere contacts and solid straight-through linkage. In addition, heavy duty bronze gears are used to drive the tuning capacitors. An aluminum cabinet eliminates any magnetic resonances and double rf shielding minimizes harmonic radiation. In fact, the second harmonic is more than 60 dB down from the full rated input.

To obtain maximum drive and maintain linearity, a resonant cathode-pi input circuit is used. The special plug-in design permits operation on any frequency from 3.5 to 30 MHz. The built-in SWR meter and rf output meter simplifies tuning up while allowing the operator to monitor the performance of his antenna.

In addition to the 2K line of linear amplifiers, Henry has just announced the new 4-K "Commercial" unit. The 4-K employs the 5CX1500A power pentode which is designed for superior linearity. This tube provides a full 4000 watts PEP input on SSB with efficiencies in the range of 60%.

Hunter Bandit 2000B

The Hunter Bandit 2000B linear amplifier is designed for operation with SSB transceivers providing 100 watts PEP output. However, the output of the exciter may be substantially higher without harming the linear amplifier. This means that most modern SSB transceivers are compatible with the Bandit.

Four UE572B triodes are used in the power amplifier; these tubes provide 2000 watts PEP input on SSB. There is no warm-up period required because the filaments of these tubes are instant heating and the solid state high voltage power supply provides instant power. When the linear is turned off, the exciter is connected directly to the antenna through the internal antenna change-over relay.

A separate adjustable rf output meter is included in the output circuit of the 2000B. This meter permits the operator to adjust the measuring circuit to accommodate different feedline impedances and to adjust sensitivity on all bands. This meter is particularly interesting in that it follows the modulation envelope much like a VU meter and provides an excellent modulation monitor.

National NCL-2000

The National NCL-2000 covers all the amateur bands from 80 through 10 meters

and includes a husky built-in 115/230 volt AC power supply. The full key down power on CW, AM and RTTY is 1000 watts, with 2000 watts PEP on SSB for the full legal limit. The two 8122 ceramic tubes used in the final were designed specifically for single sideband service and provide 800 watts of plate dissipation to assure conservative operation. The output of the NCL-2000 is very clean with the third and fifth order distortion products down 30 or 45 dB respectively; in addition, hum and noise are more than 40 dB down and the full rated input.

The use of grid regulated class AB_2 operation results in high efficiency and linearity along with easy tune-up and low drive requirements; the NCL-2000 may be driven to full rated input with any exciter delivering 20 to 200 watts PEP. The NCL-200 is protected against overload and the operator against electrical shock with the built-in safety devices. In addition to fuses, time delay and plate current overload relays, a plate power lid interlock and automatic high voltage shorting bar are included.

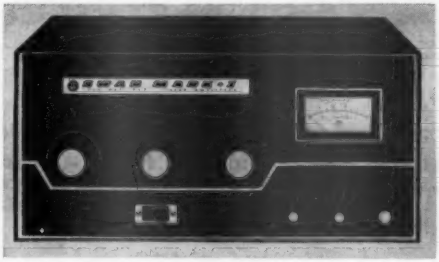
Sideband Engineers SB2-LA

The compact SBE SB2-LA linear amplifier operates at 1000 watts PEP input on 80 through 20 meters and 750 watts PEP on 15 meters. Although the SB2-LA was designed as a companion unit to the SBE 34 transceiver, it will boost the output of any SSB transceiver up to a full kW PEP.

The input circuit of the SB2-LA uses a passive grid input circuit which offers a pure resistive load to the exciter. In the output a pi network provides matching to the transmission line with band switching from the front panel.

The built-in 115 volt ac supply is a voltage multiplying type unit; the high capacitance filter capacitors provide excellent dynamic regulation. The low plate voltage—800 volts—is used with a relatively high current level. This arrangement is easier on the capacitors, rectifiers, power transformer and six parallel connected 6JE6's used in the final.

The SB2-LA has two built-in antenna changeover relays and internal blocking bias to prevent diode noise when receiving. For mobile operation the SB3-DCP inverter is available for powering the SB2-LA from a 12 volt source. The output of the inverter is 120 volts ac at 1200 watts; in mobile service the internal ac power supply is used.



Swan Mark 1

The new Swan Mark 1 linear amplifier uses two 3-400Z or 8163 zero bias triodes in a grounded grid circuit for convervative maximum legal input rating. A built-in power switch reduces the input to 1000 watts dc for CW and tune-up. The untuned input circuit provides the maximum in operating ease and permits very fast and wide range frequency changing.

The built-in 2500 volt solid state power supply may be powered from either 115 or 230 volts ac. It is very conservatively rated and the use of semiconductor rectifiers provides extended trouble-free operation. The tube cooling concept used by the Swan engineers guarantees long tube life and reduces initial equipment cost.

Dual change-over relays automatically switch the exciter in and out of the transmission line. The wide range pi-output network allows the Mark 1 linear to be used with a variety of antenna systems without the necessity of external matching networks. The metering of grid current, plate current, plate voltage and relative rf output permits monitoring of all the essential parameters and maximum tune-up ease.

. . . W1DTY

Model	Frequency Coverage 80	40	20	15	10				SSB Power (PEP)
Babcock B-500-SSB	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.0-28.5	28.5-29.0	29.0-29.5	29.5-30.0	600
Collins KWM-2	3.4-4.0	7.0-7.4	14.0-14.4	21.0-21.6	28.5-28.7	[1]			175
Collins 75S-3B	3.4-4.0	7.0-7.4	14.0-14.4	21.0-21.6	28.5-28.7	[1]			
Collins 32S-3B	3.4-4.0	7.0-7.4	14.0-14.4	21.0-21.6	28.5-28.7				175
Drake T-4 Reciter	3.5-4.0[2]	7.0-7.5[2]	14.0-14.5[2]	21.0-21.5[2]	28.5-29.0[2]				200
Drake T-4X Transmitter	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.5-29.0				200
Drake TR-4	3.5-4.1	7.0-7.6	13.9-14.5	21.0-21.6	28.0-28.6	28.5-29.1	29.1-29.7		300
Drake R-4A Receiver	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.5-29.0				
EICO 753	3.49-4.01 L	6.99-7.31 L	13.89-14.41 U	-	-				200
Galaxy V Mk II	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.0-29.5				300
Hallicrafters HT-46	3.5-4.0[3]	7.0-7.5[3]	14.0-14.5[3]	21.0-21.5[3]	28.0-28.5[3]	28.5-29.0[3]	29.0-29.5[3]	29.5-30.0[3]	175
Hallicrafters SX-146	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.0-28.5[4]	28.5-29.0	29.0-29.5[4]	29.5-30.0[4]	
Hallicrafters SR-500	3.5-4.0 L	7.0-7.5 L	14.0-14.5 U						500
Hallicrafters SR-540	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.0-28.5[4]	28.5-29.0			400
Hallicrafters SR-2000	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.0-28.5[4]	28.5-29.0	29.0-29.5[4]	29.5-30.0[4]	2000
Heathkit 12A	3.8-4.0 L								200
Heathkit 22A		7.2-7.3 L							200
Heathkit 32A			14.2-14.35 U						200
Heathkit SB-301	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.0-28.5	28.5-29.0	29.0-29.5	29.5-30.0	
Heathkit SB-401	3.5-4.0	7.0-7.5	14.0-14.5	21.0-21.5	28.0-28.5	28.5-29.0	29.0-29.5	29.5-30.0	180
Heathkit SB-101	3.5-4.0	7.0-7.3	14.0-14.5	21.0-21.5	28.0-28.5	28.5-29.0	29.0-29.5	29.5-30.0	180
National 200	3.5-4.1 L	7.0-7.5 L	13.9-14.5 U	21.0-21.6 U	28.0-28.5[4]	28.5-29.0 U	29.1-29.7[4]		200
National NCX5 Mk II	3.5-4.0	7.0-7.3	14.0-14.5	21.0-21.5	28.0-28.5[4]	28.5-29.0	29.0-29.5[4]	29.5-30.0	200
SBE SB-34	3.775-4.025	7.05-7.30	14.1-14.35	21.2-21.45					135
Swan 350	3.5-4.0 L	7.0-7.5 L	13.85-14.35 U	21.0-21.5 U	28.0-28.5 U	28.5-29.0 U	29.0-29.5 U	29.5-30.0 U	400
Swan 400[30]	3.5-4.0[5]	7.0-7.5[5]	13.85-14.35[5]	21.0-21.5[5]	28.0-28.5[5]	28.5-29.0[5]	29.0-29.5[5]	29.5-30.0[5]	400
WRL Duo-Bander 84	3.8-4.0 L	7.1-7.3 L							300

Model	1st IF (MHz)	2nd IF (kHz)	Dial Calibration	PA Tubes	Selectable Side Band	CW	AM	VOX	PTT	Offset Tuning	ALC	CW Side-Tone	Crystal Calibrator
Babcock B-500-SSB	2.455-2.955	455	100 Hz	4CX250B	yes	yes	[6]	yes	yes	yes	yes	no	Built-in
Collins KWM-2	2.955-3.155	455	1 kHz	2 6146A	yes	yes	no	yes	yes	no	yes		Built-in
Collins 75S-3B	2.955-3.155	455	1 kHz		yes	yes	yes			no		yes	
Collins 32S-3B	2.955-3.155	455	1 kHz	2 6146A	yes	yes	no	yes	yes	no	yes		
Drake T-4 Reciter	5.645		1 kHz	2 6JB6	yes	yes	yes	yes	yes	no	yes		
Drake T-4X Transmitter	5.645		1 kHz	2 6JB6	yes	yes	yes	yes	yes	no	yes		Built-in
Drake TR-4	9.000		1 kHz	3 6JB6	yes	yes	yes	yes	yes	no	yes	yes	Built-in
Drake R-4A Receiver	5.645	50	1 kHz		yes	yes	yes			no			
EICO 753					no	yes	yes	yes	yes	yes	no		
Galaxy V Mk II	9.000		5 kHz	2 6HF5	yes	yes	no	yes	yes	no	yes	no	$19.95
Hallicrafters HT-46					yes	yes			yes	no		no	$19.95
Hallicrafters SX-146	9.000		5 kHz		yes	yes	yes						$19.95
Hallicrafters SR-500					no	yes	no	[8]	yes	yes			
Hallicrafters SR-540			1 kHz	2 6HF5	yes	yes	no	yes	yes	yes		no	
Hallicrafters SR-2000			1 kHz		yes	yes	no	yes	yes	yes			$ 8.95
Heathkit 12A	2.303-2.3067		1 kHz	2 6GE5	yes	no	no	yes	yes	no	yes	no	$ 8.95
Heathkit 22A	2.303-2.3067		1 kHz	2 6GE5	yes	no	no	yes	yes	no	yes	no	$ 8.95
Heathkit 32A	2.303-2.3067		1 kHz	2 6GE5	yes	no	no	yes	yes	no	yes	no	Built-in
Heathkit SB-301	8.395-8.895	3395	1 kHz		yes	yes	yes			no			
Heathkit SB-401	8.395-8.895	3395	1 kHz	2 6146	yes	yes	no	yes	yes	no	yes	yes	Built-in
Heathkit SB-101	8.395-8.895	3395	1 kHz	2 6146	yes	yes	no	yes	yes	no	yes	yes	$26.60
National 200	5.200		5 kHz	2 6JB6	no	yes	yes	yes	yes	no	yes	no	Built-in
National NCX5 Mk II	5.200		5 kHz	2 6JB6	yes	yes	yes	yes	yes	yes	yes		$24.50
SBE SB-34	3.175-3.425	228[10]	5 kHz	2 6GB5	yes	[11]	no	[12]	yes	yes		no	$19.50
Swan 350	5.174			2 6HF5	[13]	yes	yes	[14]	yes	no	yes		$19.50
Swan 400	5.174			2 6HF5	yes	yes	yes	[14]	yes	no	yes		Not A
WRL Duo-Bander 84			2 kHz		no	no	no	no	yes	no	no	no	

1. Plus 14.8 to 15.0 MHz for WWV.
2. When used with the R-4A Receiver.
3. When used with the SX-146 receiver.
4. With accessory crystals.
5. With accessory VFO.
6. Optional plate modulator available.
7. Selectable bandwidth of 0.4, 1.2, 2.4 or 4.8 kHz.
8. With HT 16 VOX accessory, $37.95.
9. Selec
10. Thirc
11. With
12. With
13. With

SSB Power (PEP)	CW Power	AM Power	Output Impedance	SSB Generation	Carrier Suppression (dB)	Sideband Suppression (dB)	Distortion Products (dB)	Sensitivity	Selectivity (at 6 dB)
600	250		25-100	Mechanical Filter	—50	—50	—30	0.5 μV for 10 dB S/N	2.1 kHz
175	160		25-100	Mechanical Filter	—50	—50	—30	0.5 μV for 10 dB S/N	2.1 kHz
			25-100					0.5 μV for 10 dB S/N	2.1 kHz
175	160		25-100	Mechanical Filter	—50	—50	—30		
200	100		50	Crystal Filter					2.4 kHz
200	100		50	Crystal Filter					2.4 kHz
300	260		50	Crystal Filter	—50	—40		0.5 μV for 10 dB S/N	2.1 kHz
			50					0.5 μV for 10 dB S/N	[9]
200	180	100	40-80	Crystal Filter	—50	—40		1.0 μV for 10 dB S/N	2.7 kHz
300	300		25-100	Crystal Filter	—45	—55		0.5 μV for 10 dB S/N	2.1 kHz
175	150		50-75	Crystal Filter	—50	—50	—30		
			50-75						2.1 kHz
500				Crystal Filter	—50	—50			
400	300			Crystal Filter	—50	—50		1.0 μV for 20 dB S/N	
2000				Crystal Filter					
200		50	50	Crystal Filter	—45	—45		1.0 μV for 15 dB S/N	2.7 kHz
200		50	50	Crystal Filter	—45	—45		1.0 μV for 15 dB S/N	2.7 kHz
200		50	50	Crystal Filter	—45	—45		1.0 μV for 15 dB S/N	2.7 kHz
			50	Crystal Filter				0.25 μV for 10 dB S/N	[9]
180	170		50-75	Crystal Filter	—55	—55	—30		
180	170		50-75	Crystal Filter	—50	—55	—30	1.0 μV for 15 dB S/N	2.1 kHz
200	200	100	40-60	Crystal Filter	—50	—40	—30	0.5 μV for 10 dB S/N	2.8 kHz
200	200	100	40-60	Crystal Filter	—50	—50	—30	0.5 μV for 10 dB S/N	2.8 kHz
135			40-100	Mechanical Filter	—50	—40	—25	1.0 μV for 10 dB S/N	2.1 kHz
400	320	125	50	Crystal Filter	—50	—40			
400	320	125	50	Crystal Filter	—50	—40			
300			25-100	Crystal Filter	—50	—45		1.0 μV for 10 dB S/N	2.7 kHz

Crystal Calibrator	AC Supply	Price	DC Supply	Price	Remote VFO	Price	H	Size W	D	Weight (lb)	Price
Built in	Built in		Built in				7½	17	12	24	$1195.00
Built in	516F-2	$153	MP-1	$198	312B-5	$350	7¾	14¾	14	19	$1150.00
Built in	Built in						7¾	14¾	14	20	$ 658.00
	516F-2	$153					7¾	14¾	14	16	$ 795.00
	AC-4	$100	DC-3	$150	RV-4	$100	5½	10¾	11⅜	14	$ 299.95
	AC-4	$100	DC-3	$150	RV-4	$100	5½	10¾	11⅜	14	$ 399.95
Built in	AC-4	$100	DC-3	$150	RV-4	$100	5½	10¾	14⅜	16	$ 599.95
Built in	Built in						5½	10¾	11⅜	16	$ 399.95
	751	$ 80 k	752	$ 80 k			5½	14¼	11¼	25	$ 189.95 k
		$110 w		$110 w							$ 299.95 w
$19.95	AC 35	$ 80	G35A	$100		$ 70	6	10¼	11¼	13	$ 420.00
	Built in										$ 349.95
$19.95	Built in										$ 269.95
$19.95	P500AC	$120	P500DC	$150							$ 395.00
	P500AC	$120	P500DC	$150			6½	15	13	20	
	P2000AC	$395					7½	10½	15		$ 995.00
$ 8.95	HP23	$ 40	HP13	$ 60			6¼	12¼	10	12	$ 99.95
$ 8.95	HP23	$ 40	HP13	$ 60			6¼	12¼	10	12	$ 104.95
$ 8.95	HP23	$ 40	HP13	$ 60			6¼	12¼	10	12	$ 104.95
Built in	Built in						6⅝	14⅞	13⅜	17	$ 260.00
	Built in						6⅝	14⅞	13⅜	27	$ 285.00
Built in	HP23	$ 40	HP13	$ 60			6⅝	14⅞	13⅜	23	$ 360.00
$26.60	AC200	$ 75					6½	13⅜	11	15	$ 359.00
Built in	NCXA	$110			VX501	$250	6½	13⅝	11⅝	26	$ 549.00
$24.50	Built in		Built in				5	11¼	10	19	$ 419.00
$19.50	AC-PS	$ 95	[15]		410	$ 75	5½	13	11	18	$ 420.00
$19.50	AC-PS	$ 95	[15]		410	$ 75	5½	13	11	18	$ 420.00
Not Available	AC-384	$ 80	DC-384	$100			5	11¼	10	16	$ 159.95

9. Selectable bandwidth of 0.4, 2.1 or 3.75 kHz.
10. Third *H* at 455 kHz.
11. With optional SB-2 CW Codapter, $42.50.
12. With optional VOX adapter, $37.95.
13. With optional SSB-2 selectable sideband kit, $18.00.
14. With optional VX-1 VOX unit, $35.00.
15. Various DC supplies available; check with your distributor for recommendations for your station.
16. Swan 500 announced too late to be included.

HF SSB Linear Amplifiers

Model	Bands	SSB Power (PEP)	AM Power (Watts)	CW Power (Watts)	Drive Power (Watts)	Input Imped-ance	Output Imped-ance	PA Tubes	Class	Distor-tion Products
BTI LK-2000	80-10	2000	1000	1000	50-200	50	25-100	1 3-1000Z	B	—30 dB
Collins 30L-1	80-10	1000		1000	70-100	50	25-100	4 811A	B	—30 dB
Collins 30S-1	80-10	2000		1000	60-100	50	25-100	1 4CX1000A		—35 dB
Drake L-4	80-10	2000	1000	1000	100	50	25-100	2 8163	B	
Galaxy 2000	80-10	2000		1000	90-200	50	25-100	10 6HF5	AB1	—30 dB
Gonset GSB-201	80-10	2000	400	1000	65-150	50	50	4 811A	B	
Hammarlund HXL-1	80-10	1500	250	1000	60-70	50	40-80	2 572B	B	
Henry 2K-2	80-10	2000	1000	1000	80-150	52	25-100	2 3-400Z	B	—35 dB
Henry 2KD-2	80-10	2000	1000	1000	80-150	52	25-100	2 3-400Z	B	—35 dB
Henry 4K	80-10	4000	2000	2000	150	52	25-100	1 5CX1500A		—35 dB
Heath SB-200	80-10	1200		1000	100	52	50-75	2 572B	B	—30 dB
Heath KW Kompact	80-10	1000			100	52	25-50	2 572B	B	—30 dB
Hunter Bandit 2000B	80-10	2000	600	700	100	52	50-72	4 572B	B	
National 2000	80-10	2000	1000	1000	20-200	50	40-60	2 8122	AB2	—30 dB
SBE SB2-LA	80-15	1000	300	400	65	75	25-100	6 6JE6	AB1	—25 dB
Swan Mark I	80-10	2000		1000	100	50	25-100	2 3-400Z	B	

Output Indi-cator	SWR Meter	Plate Voltage Meter	ALC	Internal Antenna Relay	AC Input (volts)	AC power (Watts)	H	W	D	Weight (lb)	Price
Yes	No	Yes	Yes	Yes	115 or 230	2300	30	16¼	16	115[1]	$ 795.00
Yes	No	Yes	Yes	Yes	115 or 230	1200	7¾	14¾	13¾	39	$ 520.00
Yes	No	Yes	Yes	Yes	115 or 230	2000	30⅝	17	18¾	160	$1795.00
Yes	No	Yes	Yes	Yes	115 or 230	3450	7⅞	14	15	75[2]	$ 695.00
Yes	No	Yes	Yes	Yes	115 or 230		6	11¼	10¼	44[3]	$ 450.00
Yes	No	No	No	Yes	115		8½	12⅝	17	82	$ 345.00
Yes	No	Yes	No	Yes	115 or 230		9⅛	17½	15	66	$ 395.00
Yes	Yes	Yes	No[4]	Yes	115 or 230	3450	29½	14¾	17	135	$ 675.00
Yes	Yes	Yes	No[4]	Yes	115 or 230	3450	7	14¾	17	85[5]	$ 675.00
Yes	Yes	Yes	No[4]	Yes	115 or 230	4910	29½	14¾	17½		$ 980.00
Yes	Yes	Yes	Yes	Yes	115 or 230	1920	6⅝	14⅞	13⅜	35	$ 200.00
Yes	Yes	No	Yes	Yes	115, 230 or[6] 12.6 Vdc	1920	3½	12½	10	7	$ 99.95
Yes	No	Yes	No	Yes	115 or 230		7¾	14¾	13¼	45	$ 575.00
Yes	No	Yes	Yes	Yes	115 or 230	3450	7⅝	16½	12¾	62	$ 685.00
Yes	No	No	No	Yes	115[8]	1640	5¾	12	12½	40	$ 259.00
Yes	No	Yes		Yes	115 or 230		8½	15½	19		$ 543.00

1. Console model; also available in desk top rf unit with separate power supply.
2. Dimensions of rf unit; power supply is 7⅞ x 6¾ x 11 inches.
3. Dimensions of rf unit; power supply is 7¼ x 9⅝ x 7⅝ inches.
4. Manufacturer states that commonly available exciters will not drive unit beyond linearity.
5. Dimensions of rf unit; power supply is 6 x 14⅜ x 17 inches.
6. With external power supplies. For AC, the Heath HP-24, $49.95; for DC, the Heath HP-14, $89.95.
7. Available in kit form for $249.50.
8. SBE's SB3-DCP mobile inverter available for 12.6 Vdc.

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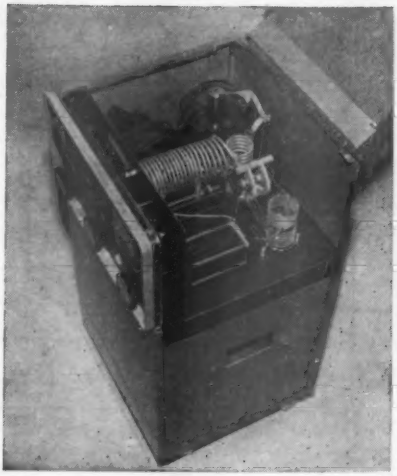

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Improved Electrical Connector for the Ham-M Rotator

After a Ham-M antenna rotator has been in use for several years, particularly in wet climates, the terminal strip at the bottom often becomes severely corroded and should be replaced. Rather than use another terminal strip which will have to be replaced in several years, a better approach is to install a waterproof connector. In addition to being waterproof and long lived, these connectors provide an extremely convenient method of connecting and disconnecting the rotator control cable when working on your tower. If you have ever installed a rotator, you know that connecting those eight control wires while you are seventy feet in the air is no mean task.

Two inexpensive connectors which are suitable for this job are the Amphenol MS 3106B-18-8S (cable receptacle) and MS 3102A-18-8P (chassis mounted plug). These connectors are available from Allied Radio Corporation* for $2.40 and $1.16 respectively. When ordering, specify stock number 47 D 7000C.

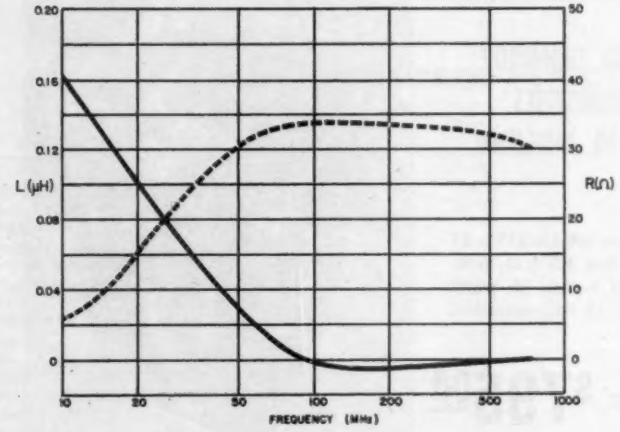
To install the chassis plug on the rotator, cut a small piece of aluminum the same size as the old terminal strip and cut a hole in its center to mount the new chassis plug. Remove the old terminal strip from the rotator and carefully label each of the control wires (1, 2, 3, etc) with a piece of masking tape. Place the new connector strip in position and install the control the control wires on the new connector. The pins on the MS connectors are labeled with the letters A through H, so it is probably most convenient to connect wire number 1 to A, number 2 to B, etc. After the control wires are connected, install the connector mounting plate in the bottom of the rotator and attach it with screws through the original screw holes in the rotator housing. At this point it is a good idea to put some household caulking compound around the edge of the connector mounting plate to prevent moisture from getting into the rotator.

This scheme has been used several times and has proven to be particularly advantageous in wet climates or where ice is likely to collect on the rotator.

. . . Jim Fisk W1DTY

*Allied Radio Corporation, 100 N. Western Avenue, Chicago, Illinois 60680.

Joe Williams W6SFM
4150 Beck Avenue
North Hollywood, Calif.
Photo courtesy Ami-Tron



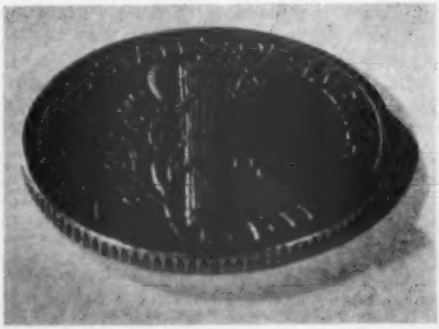
Ferromagnetic Beads

They say that good things come in small packages. And in case of ferrite beads, it's true. The Space Age and all that it implies has seen a reduction in the physical sizes of our components and some of our finished ham gear. Smallness for smallness' sake probably proves little, but when an inductor the size of a match head will perform useful tricks for us—that's handy news.

The beads have been around for a while but they haven't been readily available in amateur quantities until quite recently. The literature, similarly, has been pretty quiet on the subject of specific ham applications for this tiny component. It is most likely, then, that amateurs will expand the usefulness of these unique radioferric devices just as soon as they enjoy a wider circulation.

By simply slipping a bead over a 18 20 or 22 wire, an inductor is created. Going back to the basics for a second, we can recall that an inductor is an electromagnetic device possessing "self inductance" which is the quality of opposing changes in the current flowing through the circuit. This opposing action impedes the flow of the higher frequencies and can be assigned an ohmic value from the equation: $X_L = 2\pi fL$. When ferromagnetic matter is used as a core within or is posed near a coil, the reactive value of the inductor goes up as a nonlinear function of the *permeability* of the ferric material. Without plowing through the formulae, we can say that the Permeability Factor (μ) expresses the ratio of inductive magnification that a ferrous core will add to a plain wire inductor. For example, a toroid with a powdered iron core having a permeability factor of 10 will exhibit ten times the inductance as would the same circular coil with an air core. Meanwhile, back at the bead, we have a short length of wire having a certain small finite inductive value of its own. The addition of the bead, with a permeability factor of 900, elevates the inductance so that we have a localized high impedance point. The spectral usefulness of an Ami-Tron bead with mix "3B" is generally from 300 kHz through 300 MHz. As the frequency goes up, there is an attendant increase in the isolating ability of the bead.

The shielding action of a bead is due to the bead's offering a lossy medium to unwanted radiomagnetic influences within a circuit structure. Thus, stringing a wire with beads is a neat way to dampen rf feedback



paths that often result in either obvious or subtle parasitic effects. As we have all had occasion to witness, the feedback pick up is greater in high impedance circuitry. Grids and gates are sitting ducks for strong rf fields. In practical terms, the thing to do is to slip a bead or three over the wire connecting to the base, grid or gate. In printed circuit work, the beads should be threaded over the element lead between the semiconductor case and the circuit board. It is not necessary that the beads be grounded.

It is unlikely that ferrite beads will completely replace the ubiquitous 2½ mH rf choke, but they do offer some attractive decoupling qualities. When a bead is placed on the conductor leading to or from an active rf circuit, we have, in effect, a miniature rf choke. Its inductance may be in the order of a few nanohenries, but at VHF this can be very useful; and the simultaneous bulk shielding action is pure serendipity.

In addition to the suggestions contained in the Ami-Tron spec sheet, it is to be expected that ferromagnetic beads will find themselves being used by hams in ways that are limited only by the imaginations of the users. Consider the case of the hard to cure key click, or TVI, that develops in a sharply tuned Class C amplifier that is trying or succeeding in its efforts to go into business for itself as an oscillator. Unneutralized tetrodes such as the old work horses 813 and 807 are famous for this stunt. The spectral garbage that results usually fails to respond to the more general handbook nostrums and an operator can spend whole week ends decoupling nearby innocent circuitry. It sounds a little David And Goliath, but one bead on the right tetrode G1 could do the trick. It is just a question of time until some VHF man will make a space saving Pi-Network consisting of two capacitors and one bead. I'm anxous to try some beads between the suppressor grid and ground on a couple of sluggish pentode if stages. The mild regeneration created by this amount of decoupling should narrow the pass band and bring up the gain. But first, there is the matter of weaving a few beads into the crystal mike circuit to get rid of that rf feedback for good, *this time*.

. . . W6SFM

A package of 12 ferromagnetic beads is available for $2 from Ami-Tron Associates, 12033 Otsego St., North Hollywood, California.

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A Canadian Assault on FP8

Geoff, VE1UC, walked up to the ticket counter at Air St. Pierre and asked for three tickets to the island. The young lady at the counter gave us our tickets and boarding passes and sent us to check our baggage. Arriving at the baggage counter, the same young lady checked our bags, and at yet another counter she collected our overweight payments. As we climbed on the venerable DC-3 she accepted our boarding passes. With a polite inquiry as to whether or not she would spin the props as well ("oh no, M'sieur, they are electric-starting!"), we settled in our seats, buckled on our French accents, and were off.

This episode, on August 1, 1966 marked the end of four months' preparation for the first VE1 expedition to FP8 land.

Don, VE1AMC, and myself, VE1ADH, had driven up to Sydney, met Geoff, and now the three of us were finally in the air—hoping the fog had lifted over St. Pierre, and wondering if the book the pilot was reading was a DC-3 operation manual. Snuggled in the cargo hold was an SX111, FL100B, and Gonset 6-meter rig—all packed "lak eggs, yes?" against the whims of French cargo-handlers.

Some two hours later we arrived over the island. For miles around visibility was unlimited—no difficulty at all in seeing the vast fog bank sitting off the coast of St. Pierre. Our hearts sank lower and lower. Small wonder, our stalwart birdman was coming in for a landing—the runway was ahead—a hole in the fog—and we're down! "Say, Don, how did we ever miss those fishing shacks? Oh, well.

The runway on St. Pierre is dirt, and pretty short—so much so that when taking off the pilot makes a sharp left bank immediately upon liftoff—to avoid those fishing shacks! At one end of the runway is the smashed remains of a DC-3, which boobed up a landing—and at the other end, a similar corpse marks a poor takeoff—"Ah, but m'sieur, those planes do not belong to Air St. Pierre—our predecessors, you know". Our faith restored in our pilot (we had to fly back, y' know), we set about rescuing our bags. The cargo-handlers looked very competent and we had utmost faith in their ability—we only helped them unload our gear for the exercise!

Having cleared customs, and paid our $1 landing fee, we discussed the best way to get over to our hotel. "How's your French?" seemed to dominate the conversation for a spell. Finally I took the bull by the horns, walked up to the nearest gendarme and said "Gus Roblot?" (FP8AP was our contact on St. Pierre). "Aha", says the gendarme, breaking into a smile, "les radio-amateurs!" That's the magic word on the island—we weren't tourists, but radio amateurs! A world of difference! Off to the telephone—Gus is summoned, and soon arrives in a venerable stationwagon. Gus—a Frenchman's Frenchman—and one darn nice guy. He was indispensable to us, and anybody planning a trip to FP8 should write him. Life is so much simpler with an interpreter.

We were soon at the hotel, our bags deposited, and assured that our license would be forthcoming tomorrow. We set up our station, strung up our antennas, and went out to see the town.

St. Pierre looks very similar to any fishing village found on the Nova Scotian coast, and I commented to Don as we walked along that it didn't seem to be "a tiny Paris"—but our opinions changed very quickly. The main part of the town looks over a large square situated on the waterfront. Tourists

abound: fishermen are tending their nets, grandmas are sitting in the sun, mothers walk their babies—and on a park bench in the middle of the square, at 2 P.M. in the afternoon, this French couple is making out like nothing you ever saw in any French movie! "Sydney was never like this!" exclaimed Geoff. As we headed for the nearest outdoor cafe and our first taste of FP8 hospitality, we were prone to agree.

A work about this hospitality—it's terrific. The people are friendly and go out of their way to assist "les radio-amateurs" in every way. We had two rooms side by side, with a total of three beds, and this, with three meals a day cost each of us $6.80 per day at the New Royale Hotel. Madame Miller was an angel, and couldn't have been nicer, even at 3 A.M. one morning when Geoff and I rolled in showing the effects of the local lightlife. The food was delicious and the wine was on the table for every meal (even breakfast!).

The following day we were picked up by Gus and went off to collect our license. We soon returned—proudly bearing FP8DA, and away we went. Lots were drawn for first QSO, and VE1AMC fired up on 20 CW and shortly raised VE3GEC in Georgetown; next was WB2PXU, WB2JJF, WB2GKZ, and from then on we were working one every three minutes. With half the bank calling us, we took shifts operating and logging, and soon became quite adept at switching ops in the middle of a QSO.

Don had set his hopes on a 6 meter opening, and we had a dipole on the hotel roof. At 2030 GMT I tuned in on 6 (we were monitoring during the entire week and heard W1V1A/1 calling CQ—the band had opened! I grabbed the mike and called: "W1V1A/1, here is the French island of St. Pierre, FP8DA, calling on 6"—"what did he say that call was? F-something? Give me that again, OM" (a tremor of excitement in his voice), "W1V1A/1, here is FP8DA, FP8DA, on St. Pierre Island, how copy?" . . . . "I'll be . . . . . FP8DA on some island—this is W1V1A/1 . . . where are you guys? . . let me write this down . . ." Fellas, it was beautiful. You forgot our call, you forgot your calls, you signed after our transmissions without giving us RST and QTH—I never heard such excitement. The whole opening was calling FP8DA. and that hour's opening made the whole trip. We worked 50-odd QSO's in 9 states, and never had so much fun in our lives. I'll never forget sitting on the bed about half-way through the opening. At one end of the room sits Don, peeling off QSO after QSO, on 6, and muttering . . . "Spread out fellas, don't all call at once . . . where did they all come from?", while at the other and Geoff is working one a minute on 20 CW and singing . . "They're coming

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to take me away, ha ha, ho ho, hee hee . . ."

About 9 P.M. we packed it in, and went out to explore the night life. We soon discovered that drinks were $.40 a piece. ($.50 if you asked in English). The drinks were all three fingers apiece, and if you wink at the bartender and say "Un peu aussi, s'il vous plait" he splashes in another finger or two. Canadian or American currency is accepted, and Geoff and I managed to get utterly stiff on $2 every night we were there. Don, who doesn't indulge, kept the fires burning on 20 at night, and tucked us into bed when we managed to find our way home.

A few incidents which took place during our stay:

I was dancing half one evening with a pretty young miss, struggling the while to make a favorable impression while cursing my despicable French: finally, after a particularly frustrating session while I tried to explain how fast my green Triumph would go, she ups and says "You know, your accent really is terrible!" Turns out she is a University of Toronto student studying French on the island!

One evening Geoff and I are walking along a street in town when a very distraught woman, very obviously an American tourist, runs up waving her arms and wailing that she was lost—couldn't speak French—and ". . could you nice boys tell me how to get back to the boat?" Geoff, who was wearing his beret, puts on his bon vivant look and says "Pardon, madam, je ne parle pas l'Anglais . . . parley-vous francais?" The tourist gave him a dirty look and walked off muttering something about "another one". Another time we were on a bus waiting to go to a roadhouse outside of town, while some chaps from an American sailboat debated if they should go. Our bon vivant, avec beret, leans out the window and growls "Messieurs, le Savoy, tres bien. Venez avec moi!". The lads trooped aboard, and ended up as looped as any. I think it was Geoff kissing his fingers and winking that got them.

Wednesday night Geoff and I arrived home in the wee sma', somewhat cheerful—to find Don and some stranger ensconced in the shack in front of a SB100 hooked up to our antenna, and killing them on 20 SSB. Turns out that John and Shorty, VE3EWM and VE7AZ had arrived that evening for a few days. Anybody who worked FP8DA that night after we arrived may have wondered at the strange noises in the background—it was Geoff and myself being suppressed by Don so John could work new countries for FP8DA. The next day the boys received FP8DB, and provided us with a new country (St. Pierre, what else?)

The rigs worked FB, except for a melted pi coil on the second day. We left the transmitter out of the case after that and spent the evenings watching a room across the road increase in light intensity by a factor of 3 each time we pressed the key. The T.V. watcher never did complain (wonderful people!), but expressed his ire by heaving the occasional rock at the hotel wall. We could gauge the programs he enjoyed most by the "thump frequency".

Toward the end of the week VE1TG, George, and a chum wandered in, and we also had a visit from FP8CY. We all sat down to supper together one night, and by the time the second bottle of wine arrived we were into a real hamfest.

The Sunday following, we packed up our gear, rescued our antenna tuner from FP8DB, and folded our tents. With a last "au revoir" from Madame Miller, our fingers crossed against the fog moving down off the mountain, and a prayer that the pilot wasn't at that last party, we boarded the DC-3 and silently stole away.

Statistics? We had 700 QSO's, worked 34 states (9 on 6 meters) and 33 countries. The trip cost each of use $150 (including plane fare) for the week. The weather was warm most of the time, the wine was sweet and so were the gals. The thing that impressed us the most was the proficiency of the French drivers in survival; traffic control on the island consists of beeping as you enter each intersection, the theory being that if you hear another beep, you've had an accident.

Anybody planning a trip is urged to write Yvon Segineau at the Bureau de Radio Communications on Saint Pierre well in advance for licensing info. They are stiffening their procedures, and licenses will not be issued as casually as in times past.

We all enjoyed the trip tremendously, and unanimously invite you all to join us when we hit the beach again next summer. Return, you ask? Mais oui, messieurs! Au certainement!

. . . VE1ADH

"Get-Acquainted-with-Sideband" offer

During the course of any given week, I meet several hundred hams and as a result of these experiences for the past several years, I feel I can interpret what the average ham is looking for. Our business is, therefore, geared to supply the hams the items which they want and which they can afford to buy.

In consequence of the approaching 11-year sunspot peak, 5-band transceivers are literally selling like hot cakes, and hams who heretofore have been happy with a 3-band model have been trading them in at a relatively high rate. We think this is sound business but now we have the problem of marketing these excellently designed 3-band sideband transceivers. As an example, as I write this ad, we have in stock 36 National NCX-3's. This very popular device is rated 200 watts input for sideband, 200 watts on CW, and 100 watts on AM. It will provide 120 watts RMS out. It will match any coax fed antenna between 40 and 60 ohms impedance. It covers a frequency range of between 3480 and 4020 KC on 80; between 6980 and 7310 KC on 40; and between 13880 and 14420 KC on 20. The band width is 2½ KC. Sideband generation is by means of a 5200 KC crystal filter. The overall drift is negligible—not exceeding 400 cycles—after 15 minutes warm up. The unwanted products are down 40 db; the carrier down better than 50 db. The NCX-3 uses 18 tubes and 16 diodes. Mechanically, it is 6 1/16" high x 13⅜" wide x 11⅜" deep and weighs approximately 15 lbs. net.

We offer re-manufactured NCX-3's. (This is our term for a set that has been exhaustively checked out and which is impeccably clean), together with a choice of power supply combinations at what I honestly believe to be the lowest price in the nation. Listen to this. We will provide the NCX-3 together with a kit of power supply components for only $250 f.o.b. Harvard. This breaks down to be better than $82 per band, a lower price than any comparable offering made even for a kit on a tri-band set.

Our power supply is a universal sideband transceiver power supply which furnishes between 800 and 1,000 volts for the final, between 250 and 320 volts for the exciter stages and the receiver, 12.6 volts of AC at 6½ amps, 14 volts of DC for relays, and bias of up to minus 100 volts at 100 mils. We furnish the chassis, the bottom plate, and even a matching speaker and proper plug for the NCX-3. We furnish all of the components except the hardware with which you can mount the pieces. We tell how to build this supply. This supply weighs better than 40 lbs. when finished. It is a rugged unit. The transformers weigh in excess of 17 lbs. There are heavy, rugged parts employed in every circuit. We use, for example, four 400 mfd capacitors. As another illustration, we furnish twelve 800 volt diodes. You can build this supply in one evening and be on the air the second evening.

If you are one of the boys who as yet has not tried sideband—and you are now looking for an excuse to break in at an inexpensive price, here is your deal. Best of all, the power supply we furnish will allow you to subsequently operate any of the standard transceivers made today including Swan, Drake, Collins, Hallicrafters, and National. There would be no need, for example, to buy a second power supply in the future. We guarantee what we offer and this is, practically speaking, one of the very best buys that we have ever offered to the American ham. Trades are accepted—naturally; time payments are available for those who have credit. This offer is limited, however, to the extent that our stock shall last. Remember, you get an instruction book on the transceiver and on building the power supply and that you can operate 3 bands—CW, AM, or sideband—for only $250. We offer the same deal with our power supply wired by our own boys for only $50 more. In other words, $300 will buy a package that you can plug in when you get it.

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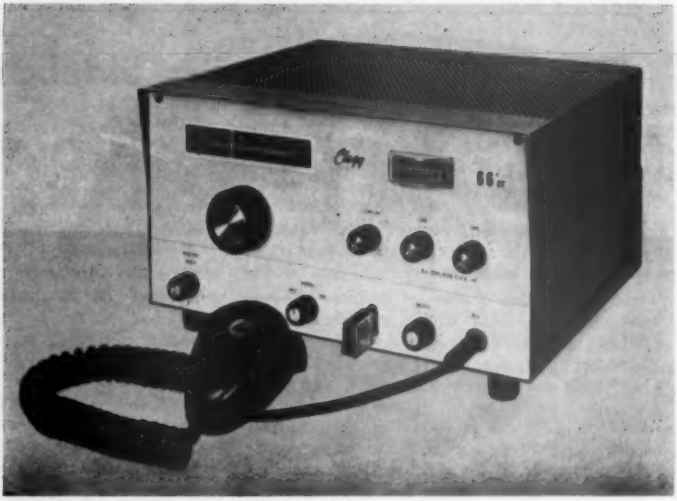

The Clegg 66'er Six Meter Transceiver

Interested in 6 meters? The Clegg 66'er from Squires-Sanders does an outstanding job and is an ideal rig for the ham who operates on our 50-MHz band. This transceiver contains a stable and sensitive receiver and a 22-watt transmitter in one compact package. It was designed specifically for the six meter band and will cover the amateur frequencies as well as those for MARS, CAP and Civil Defense. In addition, both the 117 Vac and 13 Vdc power supplies are included in the package.

The dual conversion superhet receiver is extremely sensitive and less than 0.35 μV signal will provide a signal plus noise to noise ratio of 10 dB. The basic frequency range is 49.9 to 52.1 MHz, but for special applications, an expanded tuning range is available on special order. The two *if* frequencies of 10.7 MHz and 456 kHz provide 8 kHz selectivity and result in rejection of spurious responses by more than 60 dB.

The receiver is relatively straightforward with a 6EH7 in the front end, followed by a 6DJ8 converter to the 10.7 MHz *if* and a 6BA6 *if* amplifier. The injection frequency for the first conversion is provided by a 6KE8 VFO/buffer; this combination is quite satisfactory and results in less than 3 kHz drift per hour after a 20 minute warmup. The 10.7 MHz *if* signal is converted to 456 kHz in a crystal controlled 6BE6 converter and further amplified in another 6BA6 stage, followed by a 12AL5 detector, a 6AN8 audio amplifier and a 6AQ5 audio power stage.

The AGC voltage generated in the 12AL5 detector stage is applied directly to the two *if* amplifiers and the 2nd mixer and through a Zener diode to the rf amplifier; in this way no AGC is applied to the input stage until comparatively large signals exist. The other half of the 12AL5 is connected as a series gate impulse limiter; it is very effective in cutting down ignition and other types of impulse noise.

A semiconductor diode is connected as a series squelch diode between the output of the detector and the input to the first audio stage. Whenever the cathode of this diode is more positive than the anode, the audio sections of the receiver are effectively disconnected from the front end of the receiver. Since the anode of the squelch diode is connected to the screen voltage of the

6BA6 456 kHz *if* amplifier through a decoupling network, the voltage on the anode varies automatically as the screen voltage follows the AGC level. The cathode of the squelch diode is connected to a voltage divider across the B+ supply; the cathode voltage (and therefore the squelch level) is set to the desired threshold with a potentiometer in this divider.

No tricks in the transmitter section of the Clegg 66'er either; time proven circuitry starting off with the triode section of a 6KE8 in a Colpitts type crystal oscillator. The 25 to 26 MHz harmonics of this oscillator are coupled to the pentode section of the 6KE8 through a bandpass coupler; this pentode is operated as a frequency doubler to 50 to 52 MHz and is bandpass coupled to the 12BY7 driver stage. Considerable reduction in undesired outputs is obtained by using bandpass coupling and straight through operation of the six meter driver stage.

In the final rf power amplifier, a 2E26 provides 13 watts output with 22 watts input, an efficiency of 59%. This final stage is plate and screen modulated by a pair of 6AQ5's. By carefully choosing the design constants in the modulator circuit, high frequency splatter components are completely filtered out. In addition, the operating level of the 6AQ5's was chosen so that grid clipping and plate bottoming occur at approximately 10 watts audio. Therefore, overmodulation is prevented while providing effective speech clipping at the 90 percent level.

The triode and pentode sections of a 6AN8 are used respectively as a microphone amplifier and audio driver. The pentode actually does double duty in the 66'er; in the receive mode it operates as an audio amplifier.

One of the big advantages of the Clegg 66'er is the built in power supply which will operate from either 117 Vac or 13.8 Vdc by simply plugging in the correct plug. Furthermore, either positive or negative ground dc systems may be accommodated by a simple rewiring job. The versatility of this power supply is a direct result of the two winding transformer which it uses; in the ac mode, the 117 Vac is connected to one of the two primary windings on the transformer. In the dc mode, the 13.8 Vdc drives a two transistor inverter which is connected to the other primary winding.

The Clegg 66'er transceiver is one of the most versatile six meter transceivers that this reviewer has seen. It fits right in with fixed station operation, mobile operation or even for mountain topping during VHF contests. And—if you're not satisfied with 22 watts input, you can always plug it into the Appollo linear. Zingo—675 watts dc!

. . . W1DTY

Receiver	
Frequency coverage:	49.9 to 52.1 MHz.
Sensitivity:	Less than 0.35μV for 10 dB signal plus noise to noise ratio.
Spurious responses:	Suppressed more than 60 dB.
AGC:	More than 10 db compression for 40 db signal increase.
Selectivity:	8 kHz.
Tube lineup:	6EH7 rf amplifier, 6DJ8 1st mixer, 6KE8 oscillator/buffer, two 6BA6 if amplifiers, 12AL5 detector/ANF, 6AN8 audio amplifier, 6AQ5 audio output, and three semiconductors.
Features:	Dual conversion superhet with if's at 10.7 MHz and 456 kHz; less than 3 kHz drift per hour after warmup; ANL, adjustable squelch; greater than 2 watts oudio output.
Transmitter	
Frequency coverage:	50 to 52 Mhz with external crystals or VFO.
Crystals required:	8.333-8.667 MHz, 12.5-13.0 MHz, or 25.0-26.0 Mhz in HC-6/U holders.
Power input:	22 watts.
Power output:	13 watts.
Output impedance:	52 ohms.
Harmonic and spurious outputs:	Harmonics suppressed more than 50 db; spurious outputs other than harmonics suppressed by more than 66 dB.
Tube lineup:	6KE8 crystal oscillator/frequency multiplier, 12BY7 driver, 6AN8 speech amplifier, two 6AQ5 modulators, 2E26 rf power amplifier.
Features:	100% modulation with more than 10 dB speech clipping with a −56 dB microphone; audio response ±3 dB from 300 to 3000 Hz; exciter stages broadband and multituned for rapid QSY and low spurious and harmonic outputs.
Power supplies:	117 Vac, 50/60 Hz and 13.8 Vdc supplies included.
Power requirements:	50 W on receive; 85 watts on transmitter.
Size and weight:	12" x 12" x 6½". 19 pounds.
Price:	$249.95.

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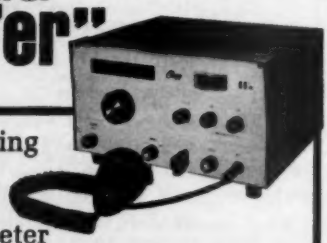
CLEGG "66'er"



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Squires-Sanders

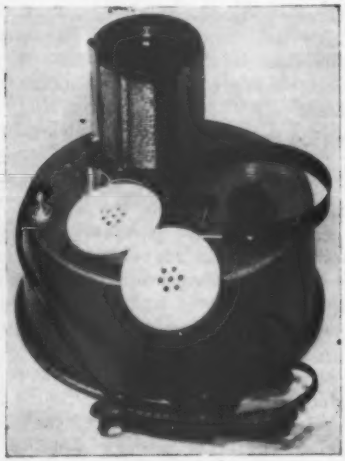
Morse Code a Stumbling Block?

If you were once a Boy or Girl Scout and had to learn morse, do you remember how you did it: A is dot-dash; B is dash-dot-dot-dot, etc—phonetically? Or even if you used a key and a buzzer it was by memory of the dits and dahs, rather than by the group sounds of the characters as in the case of speaking words.

Trying to remember the dits and dahs as simply dits and dahs has a natural limitation at the point where you require too long an interval to say to yourself: that was F or Q, etc., because the first or second dit or dah of the next leter has been sent and you have missed it while trying to identify the preceeding one. If you had to do this when listening to others talking—hesitate after each word to figure out what the word meant, what a dull conversation would result. Think how long it would take to get a reaction to a joke!

For people who have learned the individual dits and dahs it takes a long time to break through into the group-character area-short words, then longer words and real fun with code.

There is at least one method available by which you can speed up your code learning, a method which has proven itself over the years to be superior to others. This is the "Teleplex" method. Teleplex is a code sending machine using metal rolls instead of tape, so they never wear out, which is fully adjustable in speed, emitting a 750-hertz tone which seems to be the best tone at



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which the ear begins to get the dit-dah sounds as groups and words. Loud, high pitched tones apparently create unrecognized echoes which interfere with the recognition of group sounds, slowing down the learning process.

The Teleplex theory emphasizes first the 750-hertz, which cannot be varied, and second that the student should know in advance (during the early phase of the course) what words are coming, so that instead of trying to pick out the individual letters he will become conscious of the letters as group sounds in their naturally rythmic relationship, as is the case with the words you speak. Also, Teleplex permits a gradual almost imperceptable, change in speed, so that rather than trying to copy 5 wpm faster than you can now copy, you can increase the speed by fractional wpm and not be under such strain. In this way you can continue to recognize the word groups, rather than jumping into a speed where the groups are indistinguishable.

Teleplex can be purchased or rented. Write them at 739 Kazmir Court, Modesto, California.

. . . K1RA

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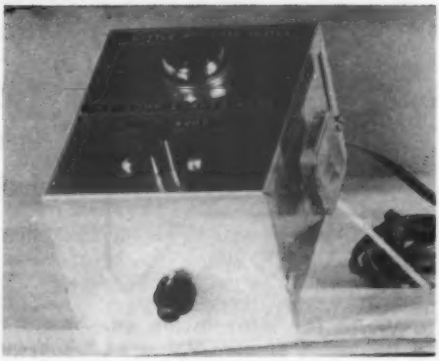
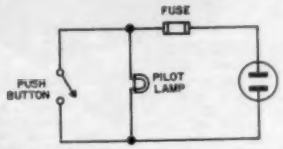
The Little Gem Fuse Tester



The Little Gem Fuse Tester.

Here's an oldie that we haven't seen around for ten or fifteen years. There are several versions of this little first-day-of-April gadget. Ours calls for a neat little Minibox, a nice big bull's eye pilot light (110 volt variety), a fuse in its holder, a push button, a spare fuse container with spare fuses, and a cord with plug. See the photo.

On ours we put the title "Little Gem Fuse Tester" on a plastic label at the top. In the center we put "If lamp lights, fuse is good". There is no label on the push button. Everybody has an uncontrollable urge to push a button. If you push the button, of course the fuse is blown and the light goes out.



Schematic of the Little Gem Fuse Tester.

There are several approaches to the use of this "Little Gem". One way is to simply lay it on an associate's desk or work table. He will probably come in pick it up, plug it in, and try it out. As soon as he realizes that he has been had he will put it on the next person's desk. . . The spare fuse container may have to be refilled a time or two during the day. One variation is to leave out the fuse, in which case the building fuse blows and possibly the lights go out. Some administrative personnel may take a dim view of this!

In our case we made out a very official interdepartmental memo stating that we needed some lay experimenters to determine the value of the device. Then on a second sheet (not to be read previous to experimenting) we put a bunch of questions like "Was the fuse good?", "Is it still good?" etc. leading up to a "Happy first day of April to you".

You can have a lot of fun with the "Little Gam Fuse Tester".

. . . W7CSD

What's New for You?

This column is devoted to short, timely items of interest to technically-minded hams. We'd like to cover new semiconductors and other components of special interest, new surplus, technical meetings, clubs and nets, comments about 73 articles, and so forth. All will give credit to the submitter. Please get all items in as soon as possible so that all readers will be able to take advantage of them. Keep them short, please. Send to: What's New, c/o Paul Franson, 38 Heritage Rd., Acton, Mass. 01720.

Paul Franson WA1CCH

RTTY Circuit Boards

The circuit boards for RTTY gear on pages 34-37 of the January issue are available from the Harris Company, 56 E. Main, Torrington, Conn. The converter (decoder) is $4, and the generator (decoder) is $2. All etched circuit boards shown in 73 are available from the Harris Company. Write them if no information is given.

Propagation Chart

APRIL 1967

ISSUED MARCH 1

J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	7	14	21*	28	21*	21	21	21
AUSTRALIA	21	14	14	14	7*	7*	14	14	14	14	21	21
CANAL ZONE	21	14	14	14	7	7	14	21	21	28	21	21
ENGLAND	14	7	7	7	7	14	14	14	21	21	21	14
HAWAII	21	14*	14	7*	7*	7	7	7*	14	21	21	21
INDIA	14	14	7*	7*	7*	7*	14	14	14	14	14	14
JAPAN	14*	14	7*	7*	7*	7	14	14	14	14	14	14*
MEXICO	21	14	14	14	7	7	14	21	21	21	21	21
PHILIPPINES	14*	14	14	7*	7*	7*	7*	14	14	14	14	14*
PUERTO RICO	14	14	14	14	7	7*	14	14	21	21	21	21
SOUTH AFRICA	14	14	7	14	14	21	21	21	21*	21*	21*	21
U. S. S. R.	7	7	7	7	7	14	14	14	14*	14*	14	14
WEST COAST	21	14*	14	14	14	7	14	14	14	21	21	21

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	14	7	14	21*	21*	21	21	21
AUSTRALIA	21	21	14	14	14	7*	7*	14	14	14	21	21
CANAL ZONE	28	21	14	14	7	7	14	21	21	28	28	28
ENGLAND	14	7	7	7	7	7	14	14	14	21	14	14
HAWAII	21	21	14	14	7*	7	7	7*	14*	21	21	21
INDIA	14	14	7*	7*	7*	7*	7*	14	14	14	14	14
JAPAN	14*	14	14	7*	7*	7	7	14	14	14	14	14*
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14.
PHILIPPINES	14*	14*	14	7*	7*	7*	7*	14	14	14	14	14
PUERTO RICO	21	14	14	14	7	7	14	21	21*	21*	21*	21*
SOUTH AFRICA	14	14	7	14	14	14	21	21	21*	21*	21*	21
U. S. S. R.	7	7	7	7	7	7*	14	14	14	14	14	14

WESTERN UNITED STATES TO:

ALASKA	21	21	14	14	7	7	7	7	14	14	14	14*
ARGENTINA	21	21	21	14	14	7	14	21	21	21*	21*	21
AUSTRALIA	28	28	28	21	21	21	14	14	14	14	21	28
CANAL ZONE	28	21	14	14	14	14	14	21	21	21	21	28
ENGLAND	14	7*	7	7	7	7	7*	14	14	14	14	14
HAWAII	28	28	21	21	14	14	14	7*	14.	21	21	28
INDIA	14	21	14	14	7*	7*	7*	7*	14	14	14	14
JAPAN	21	21	21	14	14	14	7	7	14	14	14	21
MEXICO	21	14	14	7	7	7	7	14	14	14	21	21
PHILIPPINES	21	21*	21	14	14	14	7*	7*	14	14	14	21
PUERTO RICO	21	14	14	14	14	7	14	21	21*	21*	21*	21*
SOUTH AFRICA	14	14	7	7*	7*	7	14	14	14	21	21*	21*
U. S. S. R.	7*	7*	7	7	7	7*	7*	14	14	14	14	7*
EAST COAST	21	14*	14	14	14	7	14	14	14	21	21	21

• Very difficult circuit this hour.

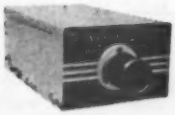
* Next higher frequency may be useful this hour.

Good: 1, 4-9, 11, 13-15, 17-20, 24, 25
Fair: 2, 3, 10, 12, 16, 23, 26, 27, 29, 30
Poor: 21, 22, 28
VHF: 10-14

★ SALE ★

MODEL 400 AND 501

TV CAMERAS



From $125.00

Each month we have a limited quantity of used TV cameras which we make available to hams at greatly reduced prices. Some cameras were used as demonstrators by our salesmen; others like our Model 400 were traded in for our 501. A few are back from being rented out on special temporary surveillance jobs. Some were modified slightly to fit the particular job and may have extra holes or vary slightly in appearance from the photos. All have been checked out and are guaranteed for 90 days. Complete with vidicon and lens.

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For specifications on the 501 see our other ad elsewhere in this issue. For specifications on the 400 see 1965 issues of 73.

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Technical Aid Group

The first members of 73's Technical Aid Group are listed below. They are willing to help other hams with their technical problems. If you have a concise question that you think can be answered through the mail, why not write to one of the hams on the list? Please type or write legibly, and include a self-addressed stamped envelope. One question to a letter, please.

If you'd like to join the Technical Aid Group and you feel that you are qualified to help other hams, please write us and we'll furnish complete information. It's obvious that we need many helpers in all parts of the country and in all specialties to do the most good. While 73 will try to help with publicity and in other ways, we want the TAG to be a ham-to-ham group helping anyone who needs help, whether they be 73 readers or not.

Don Nelson WB2EGZ, EE, 9 Greenridge Road, Ashland, N.J. 08034. VHF antennas and converters, semiconductors, selection and application of tubes.

Tom O'Hara W6ORG, 10253 East Nadine, Temple City, Cal. 91780. ATV, VHF converters, semiconductors, general questions.

Stix Borok WB2PFY, high school student, 209-25 18 Ave., Bayside, N.Y. 11360. Novice help.

George Daughters WB6AIG, BS and MS, 1613 Notre Dame Drive, Mountain View, Calif. Semiconductors, VHF converters, test equipment, general.

Roger Taylor K9ALD, BSEE 2811 W. William, Champaign, Ill. 61820. Antennas, semiconductors, general.

Jim Ashe W2DXH, R.D. 1, Freeville, N.Y. Test equipment, general.

J. Bradley K6HPR/4, BSEE, 3011 Fairmont St., Falls Church, Va. 22042. General.

Howard Krawetz WA6WUI, BS, 654 Barnsley Way, Sunnyvale, Cal. 94087. HF antennas, AM, general.

Robert Scott, 3147 E. Road, Grand Jct., Colorado 81501. Basic electronics, measurements.

J. J. Marold WB2TZK, OI Div USS Mansfield DD728, FPO San Francisco, Calif. 96601. General.

Hugh Wells W6WTU, BA, 1411 18th St., Manhattan Beach, Calif. 90266. AM, receivers, mobile, test equipment, surplus, repeaters.

Richard Tashner, WB2TCC, 163-34 21 Road, Whitestone, N. Y. 11357. High school student, general.

Wayne Malone W8JRC/4, BSEE, 3120 Alice St., West Melbourne, Fla. 32901. General.

Louis Frenzel W5TOM, BAS, 4822 Woodmount, Houston, Texas 77045. Electronic keyers, digital electronics, IC's, commercial equipment and modifications, novice problems, filters and selectivity, audio.

Michael Wintzer DJ4GA/W8, MSEE, 718 Plum Street, Miamisburg, Ohio 45342. HF antennas, AM, SSB, novice gear, semiconductors.

Clyde Washburn K2SZC, 1170 Genesee Street, Bldg. 3, Rochester, N. Y. 14611. TV, AM, SSB, receivers, VHF converters, semiconductors, test, general data.

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Hildreth Press

The changeover in printers has gone extremely smoothly and our old printer has been most cooperative in getting all our materials out to the new press in Illinois. Changing printers is a tremendous undertaking for a magazine because printing schedules are upset, huge amounts of material must be moved and accounts must be closed out. Hildreth Press, our previous printer, put forth a great effort and took care of everything smoothly and efficiently; in a matter of days our new printer was all set to go.

And then the biggest snowstorm in fifty years paralyzed the Illinois area; traffic came to a standstill, the pressmen couldn't get to work and little, if anything, was getting in and out of Pontiac, Illinois, including 73 magazine. Finally, however, the February issue hit the street. It will take us several months to make up the time lost because of the storm, but by cutting a little off the schedule each month, we hope to be completely back on schedule by the time you get the June issue.

Jim Fisk W1DTY

Aligning Decals

Having trouble lining up decals or dry transfer labels on that new piece of equipment? Without some kind of aid, it's a little tough to line up the labels on a panel and make sure that they are all parallel. One of the easiest ways to do this is to stretch a rubber band around the panel and align it with a ruler; all the decals placed along the rubber band guide will be perfectly aligned. This system has the advantage that no alignment marks are left on the panel after the labeling is done.

. . . Jim Fisk W1DTY

2000 ARTICLES?

In the 75 issues of 73 between October 1960 and December 1966, over 2000 articles have appeared. Find the ones you want quickly with our NEW six year cumulative index. It lists all articles by subject in easy-to-find form. The index is available now. Index 25¢

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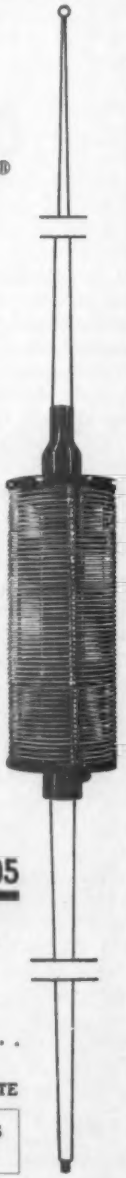

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Climbing the Novice Ladder

Part V: A stroke of luck for Judy

On the Wednesday following their last session at FN's shack wherein Larry and FN put Judy and Joe through an informal preliminary verbal exam, the kids toured the local ham supply stores in search of a receiver for Judy. At all three places, they unearthed several used receivers of conventional ham manufacture as well as a couple of the Command type of military surplus. With one exception, none of them seemed to quite fit the picture. Some were priced considerably beyond Judy's budget, a few were in somewhat questionable 'as is' condition and the Command sets, although moderately priced, would both require more extensive modification than desirable for a beginner. However, at Daly's Ham Shack they found a little Conar Model 500 novice receiver kit which had been 90% completed only 11 steps remained to be accomplished. Tim Daly explained that the young fellow who had purchased it initially had just been inducted into the military service and had left for duty before he could complete it. He had left the little rig with Tim to dispose of for him. The previous workmanship appeared to be neat and substantial and that remaining to do did not appear to be too difficult of accomplishment. Tim was offering it 'as is' at the very attractive price of $20.00 which would not take too many spareribs from Judy's piggy bank. Tim agreed to hold it until Judy could talk to FN and get his opinion.

That same evening Judy's Dad agreed to drive her out to FN's place. After explaining briefly what she and Joe had found at the various stores, Judy said, "Gramps, both Joe and I think the little Conar would be a pretty good bet. I'm sure I could finish it and it's well within my budget. Joe phoned me just before I came out here tonight and said he'd run into Larry at the gas station and told him about it. Larry knew the guy who had started building it and had seen the job. He told Joe that it sounded like a pretty good deal to him but to talk to you about it first."

"Well Judy", replied FN, "you say there are but 11 steps to complete in the instruction manual. I've got a Conar manual here, let's see what these really amount to". So saying, FN reached into his filing cabinet and pulled out the assembly and wiring instructions. Counting back 11 steps he said, "Actually this involves only installing and soldering in place five relatively simple pieces of wire. The other six steps have to do with the adjustment and alignment procedure. This, you'll remember I told you and Joe awhile back, is not always as easy a procedure as it may appear to be on the surface. The Conar is a straight superhet which is of course, desirable for selectivity and sensitivity. The schematic is conventional and with proper instruments, the alignment should be relatively simple as the adjustments seem to be well detailed in the book. I've got suitable test equipment and if we deecide this to be the rig for you, we can all get together here on my bench and bring the little chick to life. Let's do this; I've got to go to town Friday so suppose tomorrow I call Tim Daly and ask him to hang on to it until I come in and I'll have a look at what's been done and what's to do. After I give it the eagle eye, I'll give you a definite 'yeah' or 'nay' . . . what say?"

"Oh fine, Gramps, I'll really appreciate it and if you say go I'll pick it right up and we can get busy on it".

As FN nodded agreement, Judy's Dad surprised them when he said, "Say FN, if Judy goes for this little receiver, mind if I come along when she works on it? I'm gettin' kinda interested in this ham stuff myself after listenin' to the kids drone away with that code hickey they've got out in my storage shed".

"Well, blow me down, Tom," replied FN, "I never thought the radio bug's stinger was long enough to penetrate that tough old carpenter's hide you walk around in; sure thing, drag yourself right along if Judy gets going on this and bring Edna with you . . . she and Ma can swap valley gossip while we're cluttering up my bench . . . glad to have you".

True to his word, FN called Tim Daly who agreed to hold the little receiver until FN dropped in on Friday and checked it over. His inspection indicated that while perhaps not exactly a professional job of workmanship by the previous builder, it was substantially done, connections well soldered and the general assembly indicated that care had been used throughout. Telling Tim that he would give Judy the green light on it, FN finished his errands in town stopping at Judy's place on the way home and giving her his decision. Her Dad was busy with a kitchen drain board job on the other side of town but Judy was sure that he'd take her to town in the morning and pick up the Conar. FN invited her to bring it right out to his shack then if she'd like to get started on it but first he cautioned her not to neglect her study of the examination material reminding her that the following Saturday both she and Joe were due for their formal code exams and shortly thereafter, the written portion. "Oh, I won't Gramps; I'm still reading myself to sleep with the books every night and I've got code, rules and regulations practically running out of my ears" she laughed.

That evening, Joe phoned Judy to check on progress and she invited him to join her at Tim Daly's in the morning and they'd pick up the receiver and he could accompany she and her Dad to FN's and get in on a bit of the final completion of the little rig. Joe eagerly agreed and both kids looked forward with eager anticipation to an enjoyable session on FN's bench.

As Judy had surmised, her Dad readily agreed to take her down to Daly's, pick up the receiver and then out to FN's shop, so the next morning Judy cranked the tail of her piggy bank until it had spewed forth twenty of the closely hoarded dollars from her summer odd jobs. Tom Mansfield backed the station wagon out of the garage and they took off for town. Joe was waiting so it was but a matter of minutes to empty her poke into Tim Daly's hand, take a receipt, pick up the little box and head for FN's. They stopped by Judy's place to pick up her mother who would visit with FN's XYL while Judy and the men folks delved deeply into Pandora's electronic box.

FN started the session with, "All right now; you kids take the assembly manual, figure out the five wires you will still have to install and get them placed and soldered. Tom, you hang over their shoulders and soak up a bit of this stuff . . . you asked for it you know and you'll soon see what you've let yourself in for". FN chuckled and continued, "I'm going to be clipping the hedge out back; when you're through with those wires let me know and we'll lay out the test gear and go through with the alignment."

Some forty five minutes later both young-

Judy and Joe went shopping for a receiver for Judy.

sters were satisfied that they had it finished and Joe went out and rounded up FN. He too considered the wiring satisfactory and announced, "We've reached the point now where we're ready to give it the initial 'smoke test'; you know, plug the cord into an AC outlet, turn on the power switch and 'tune for minimum smoke' . . . go ahead Judy". Somewhat dubiously she was about to gingerly push the plug into the outlet when FN stopped her with, "Uh uh, Judy; check your panel switch *first* and be sure it is in the 'off' position; always do this with *any* piece of gear before you plug it into a power source. Just like your Dad's FM radio, the power switch here is part of the volume control; click the pointer to the 'off' position. That's right, *now* plug in the power cord". This done, FN carefully scrutinized the chassis for a few moments then said, "No smoke; so far so good. Now click the power switch to 'on' and let's take another look; good, the little panel indicator lamp glows and we blew no fuses. All of the tubes show a normal dull glow inside their envelopes so apparently all heater circuits are correct. Now advance the volume control slowly clockwise; the tubes should be warm enough now to produce some background noise in the speaker. Yep, there she comes . . run the volume clear to maximum; the background increases normally as you go . . fine. Turn the volume back down a bit now and just let her set and 'cook' while we haul out the test gear for alignment; we'll use a signal generator and a vacuum tube voltmeter for these final steps". Just then FN's XYL announced lunch for all hands on the patio and, at FN's direction, Judy turned the power switch to 'off' and pulled the power cord from the outlet. "Better we get a bite or two under our belts then we can come back and go right through the final steps without interruption" and, after washing up, the 'junior scientists' joined the oldsters at the picnic table.

After bountiful replenishment of the body fuel, FN stoked his trusty briar and when she was drawing well, sleeves were figuratively rolled up and the curtain was ready to rise on the final act. "Here's the test equipment, kids; Joe knows how to use it from his class work; the book tells you just what to do with it, where to connect it and how to use it. I'm not going to say a word; simply follow the instructions and I'll stand by in case you hit a puzzle or two. Tom, you can watch, but don't touch; you're not going to sneak into the ham hobby by jumping into something right in the middle like this. If you get serious about this ham business you're going to have to start from scratch like the young 'uns did. Ok; get going kids".

Step by step with an occasional question to FN to clear a doubtful point, Judy and Joe worked through the various tuning slug adjustments. At FN's suggestion, each would carry through one step and the other would repeat the process as a double check before proceeding with the next. They discovered that meticulous care was necessary as they proceeded; many of the adjustments were sufficiently critical that the peak performance point could be easily passed over. Obviously alignment was not a procedure which could be handled on a 'hit or miss' basis with any expectation of realizing the full potential of a receiver. Ultimate performance could be reached only by devoting plenty of time to careful adjustment and simultaneous checking of meter indications. At last however, the final screw had been turned, a re-check of some of the operations performed and with a couple of relieved and profound sighs, tension relaxed. "Well, Gramps, what you think?" queried Judy, patting her copper-hued locks back to some semblance of a girlish hair-do.

FN smiled and said, "Bravo! There were a few times there along the line where I was tempted to shove in my two-bits worth but I decided to let it ride. You've done rather better than I had expected and you have the little rig in pretty fair shape right now to drag in a pretty good assortment of signals . . let's see if it will. Tom, I'll relax a bit and let you stick your finger just a little way into the pie. Disconnect the test leads . . . ah, ah . . . remember to pull the AC plugs *first* . . . and set the test gear to one side. Now take these two clip leads and connect the antenna and ground terminals of the receiver to these two terminals on my bench. That will connect the receiver to my test antenna; just a random length of wire out to the old maple tree . . about 65 feet, and to my ground system . . the cold water piping of the house in this case. Now Judy, it's your receiver so the honor of ushering in the first signals should be yours. Again, follow the

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Joe, Judy and Judy's Dad Tom finished the last steps in building the Conar receiver.

procedure outlined in the book, setting all of the controls to the specified positions. Now, slowly turn the main tuning knob slowly across the dial scale." Wow! From the myriad of peeps, whistles and birdies of every imaginable pitch which rattled the speaker, one would think that an emergency evacuation of a monstrous apiary was being staged!

Completely awed, Judy's jaw dropped, her eyes momentarily glazed and she slowly turned to FN with a blank and unbelieving stare. Laughingly he said the magic words, "Well girl, you've really made it; you grabbed the bear by the tail but you can relax and let go now. Let's see what we've got". Reaching across to the tuning knob, FN picked off a shrill high-pitched signal of more than adequate room volume and far above the speed capacity of the kids at this stage. Reducing the gain to a more comfortable hearing level he announced . . . "That's NSS at Annapolis, Maryland . . a Navy station. Here in Ohio we consider that as practically local; let's keep going. There . . another Navy . . NAA up in the state of Maine . . . we're doing better. Now, who's this? CKN . . . that's still better . . . out on the West Coast in Vancouver, British Columbia . . . Canadian Government station. So, we're in the commercial and military portion of the 40 meter band . . let's see if we can chase down the amateur segment. Should be about here . . nope, that's a foreign short wave broadcasting station although the dial reads in the amateur spread. Could be though as many of those furriners show total disregard for international frequency assignments and just bust through wherever it suits them. Or, it could be that your dial pointer actually *is* off and the BC station *is* in a legal spot. Remember, we have made no effort to relate the pointer to the dial scale as yet; that's a minor adjustment and is explained clearly in the book. Before you tackle that let's see if we can grab a few ham signals somewhere on the dial to give us a cue which way to go. We'll tune slowly over the whole scale; commercial, commercial, Navy . . a voice but it sounds like a Mexican short wave BC station. Here's another voice . . wait . . that's in English . . put the BFO knob on AM and retune slightly; fine, and it's a ham calling "CQ 40"; listen. A WA6 . . . that's out in California . . Sacramento, he says. Well, we've hit the high end of the 40 meter ham band then; phones in that band are authorized to use the frequencies from 7200 to 7300 kc, or if you prefer, kHz, but your pointer is almost at the high end of the scale . . about 7600 kHz for a guess. Means you're going to have to back the pointer up a bit and at the same time hold the position of the tuning capacitor plates. Suppose we pick the middle of the amateur 40 meter band for a starter . . 7150 kHz. Now there are two ways to make this adjustment and you're going to have to juggle a bit between them. The manual is very clear in explaining both the mechanical adjustment involved in shifting the pointer as well as the electrical setting to be achieved by adjusting the slug in the proper tuning inductance. I'm going to set my signal generator going at exactly 7150 kHz with the 400 hertz (cycle!) modulated tone turned on; there. Now tune in that signal; that's it . . that steady drone. Your job now is to keep that tone and adjust the pointer both mechanically and electrically until it indicates exactly 7150 on the scale. Go ahead now and follow the procedures described in the book."

Never a speedy process, this took a bit

of time and an occasional tip from FN but after some ten minutes of careful adjustments, Judy had it made and her beaming face reflected satisfaction. After an 'OK' from FN he continued, "Suppose, Judy, that you take a little breather now and we let Joe take a whirl at doing the same thing but on the 80 meter band. From here on the adjustments will be purely electrical so that we don't upset the mechanical position which Judy has established for the pointer. Joe, set your band switch on 80, put the BFO back on CW and follow the book." Again an encouraging number of signals though not so many as on 40; 80 meters in the daytime is not the best band in the world except for relatively local contacts but there are generally sufficient signals to permit the adjustment process. Hams, except for the novice sector and maybe a few phones are somewhat lacking but Joe had soon established a starting point and using the signal generator, this time set for 3725 kHz, took about the same length of time to corelate the pointer and dial with the tone and adjusting only the tuning slug in the proper coil. All that was now left was the 15 meter band and this being somewhat trickier in balancing due to the higher frequency, FN worked with both youngsters to bring this novice 'DX' band into proper play with the help of the scores of signals present as the band was 'open'.

It had been a rather rugged but very fruitful several hours and successful completion of the receiver was celebrated with a heaping mound of Grandma's famous doughnuts and a jug of fresh cider which FN produced from a dark corner cupboard in the cool basement. "What a day" . . . "Boy, that was rough" . . . "Whew; I think I know a *little* somethin' about a superhet receiver now" . . . and similar outbursts were bandied about. Soon the doughnuts were reduced to a plateful of crumbs, the cider level to a significantly new low and relaxation was complete. By now the afternoon was well along and as Joe had come out with Judy's family rather than on his Honda, Tom would take Joe home and stop in town on the way back to pick up 100 feet of antenna wire and a couple of insulators; he and Judy were determined to get up at least a temporary antenna of some kind as soon as they got home! Why waste Saturday evening on some dumb gunplay on the boob tube tonight?

All loaded, the receiver carefully held on Judy's lap (just *try* and take it from her!) the little band took off amid a chorus of " 'Bye Gramps and Gran . . . thanks for the help FN . . . sure had an enjoyable day". FN had instructed Judy in the adjustment of the antenna trimmer once she had the receiver connected to her own antenna and had reminded both kids that the following Saturday was their formal code exam day . . . don't get off the practice track meanwhile. They had earlier assured him that they had both sent their request for license application forms to FCC a week ago and hoped to have them to bring to the code exam.

It had been a somewhat wearing day and FN, though a bit on the weary side, had thoroughly enjoyed joining in the enthusiasm of youth but now sought a bit of peace and quiet through a little 'rag-chewing' with a few of his old cronies on the air until the welcome chow call ended the working day.

. . . W7OE

Next month: The formal code exam and a discussion of transmitters.

Dating Batteries

Too often it happens that when we use a piece of gear such as a portable transceiver, a transistor radio, or a flashlight, its batteries will pick that moment to take their departure to the Great Beyond. One good way to minimize these annoying occurrences is to write the date of purchase on each battery. With that date inscribed on the batteries, one can tell at a glance approximately when they should be replaced.

It is best to write the date on self-sticking unprinted labels or pieces of masking tape and then sticking them to the batteries. On batteries with cardboard cases, the date may be written in ink directly on their cases. A rubber stamp is also suitable for cardboard cases.

. . . William Bakewell WB6GHB

WTW Gets Under Way

You fellows who have been waiting to get into the WTW DX award should start right now because things have started rolling, interest is building up fast and the cards are starting to come in from all over the country. So far none have arrived from overseas stations, but you can be sure that many of them are working on it at this time. I had no idea that anyone would qualify during the first year (actually only eight months), but as usual I guessed wrong because many fellows have already sent in their cards and more are arriving as each week goes by. I wish I could enter this one but I have disqualified myself because I don't want anyone looking down their nose at me nor do I want any suspicion that there was any monkey business. Up to now I have personally checked each QSL card and they have all looked good so far, but we are putting everyone on notice that if the dates and call signs on each card are not easily readable they will be rejected. We don't want anyone getting peeved at us about such matters, but I want to put everyone on notice that we are going to be looking at every card sent to us with a strong reading glass and if any looks even the slightest bit "phoney" we will reject it without batting an eyelash. We suggest that you carefully look over your cards before submitting them and get duplicates of any that are a little fogged up, blurred, call sign changed, dated changed, etc. This will save us the trouble of rejecting the cards at this end and at the same time it will keep us from even the slightest suspicions of any of you. So far I am glad to say that all the cards submitted have looked ok, but sooner or later I am sure some questionable ones will show up.

When you fellows send in your cards for WTW how about sending along a few photos of yourself, your station, antennas, and some biographical dope so we can put it in 73 when writing up your reports. Presently quite a few fellows have qualified for WTW and as time goes on we expect the country totals to build up fast. Getting the cards has been a problem from some stations, but they *can* be extracted because I have seen all the cards submitted and this shows that it can be done. If you are being bothered by not receiving QSL cards, maybe you have worked the wrong stations! I would like to emphasize the importance of filling out your lists of QSL's that you send to me or any of the verification clubs. We would like for these lists to be done the same way by everyone who submits cards to us. Later on we will have some printed forms for everyone to use, but for the present time use standard 3 by 5 inch filing cards; we will let you know when the forms are available.

Put your call sign and address on each 3 by 5 card along with the date that you mailed the card. Please include your claimed contacts in the order of their prefixes (alphabetically), the date of the QSO, and the country you claim the QSO was with. I have received quite a few cards with no countries listed or dates. If this information is not shown on your filing cards in the future, the whole kit and kaboodle will be returned to you without any record being made that we have received them. This will place you further down the WTW list with a higher serial number on your WTW certificate. I'm sure you don't want this to happen.

We have issued nine more WTW certificates since the list we published last month. These fellows all got low serial numbers on their WTW certificates and one of these days they will be very proud to show these low serial numbers to the other fellows. Many more of you can do the same thing if you hurry and get your cards to me. Although I didn't mention it last month, note the Dan Redman K81KB and Jim Lawson WA2SFP each have two certificates; Dan has one for CW and one for SSB while Jim showed with 100 pasteboards for SSB on both 20 and 15 meters. These are no mean feats when you consider that it was all done in less than a year.

Bob Wagner W5KUC, "Hop" Hopple W3DJZ and Gay Milius W4NJF have gone one step further. These fellows have gone

all out on 14 MHz SSB by working and getting QSL's for 200 countries in less than one year. This just goes to show that it's not impossible if you work stations that QSL promptly. On the other hand maybe these fellows have some secrets about extracting cards from some of the toughies?

Are we going to count K1IMP/KC4's operation on Navassa? You can bet we will count it—they were there weren't they? In the future you can be sure that the WTW Awards Committee will count all such operations if the country is on the WTW countries list and the operator was actually there. Please pass this info on to any of your friends who are planning a DXpedition to some good spot. If the country is recognized by one of the national amateur radio societies, WTW will give credit and their trip will be worthwhile.

Next month I hope to have a complete list of all DX Clubs which we have appointed for checking your WTW cards. This way your cards won't have to be sent so far; you'll save on postage and there will be less chance that your cards will get lost in the mail. We have quite a few check points already, but we are still looking for DX Clubs in the following areas: W1, W2, W5, W8, W9, WØ, Africa, the Middle East and South Asia (India, Pakistan, Iran, etc). Any volunteers?

We still have not heard from anyone for either CW or SSB on 10, 40, 80 or 160 meters, so certificate number one is still QRX for some sharp operator. Number one on 15 meter CW hasn't been claimed either. so fellows, join the WTW fun; come on in, the water's fine. . . . Gus W4BPD

WTW Certificates Issued Since Last Issue

SSB WTW-200		
Number		
2	"Hop" Hopple W3DJZ	14 MHz SSB
3	Gay Milius W4NJF	14 MHz SSB
SSB WTW-100		
14	James Edwards WA5LOB	14 MHz SSB
15	James Lawson WA2SFP	21 MHz SSB
16	Bill Galloway W4TRC	14 MHz SSB
17	Olgierd Weiss WB2NYM	14 MHz SSB
18	Jose Toro KP4RK	14 MHz SSB
19	Joe Hiller W40PM	14 MHz SSB
20	Gerald Cunningham W1MMV	14 MHz SSB

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Gus Browning W4BPD
Cordova, S. C.

Gus: Part 22

At the end of my last "chapter" I was with John, 9U5JH in Burundi. My stay with him and his small family was a FB one, plenty of good food, sleeping all day and operating all night. I wonder how it would have been if 15 and 10 meters had been open so I could also stay up all day to work the fellows? I suppose you could work yourself to death with all the bands open like they are right now. Maybe soon I will get to know if I get away on another trip. Don't be surprised if this happens. Right now my little weekly DXERS magazine is working me 14 to 16 hours EVERY DAY, but I am sure it will smooth out and I will be able to get away on another trip, sooner or later. During that time there will be a single page bulletin to keep all the DXERS informed.

After about five days of operating in Burundi I asked John about how things were up in Rwandi and was told that there was some "political" trouble up there. I later on found that there is "political trouble" most of the time in most of those countries down there. Sometimes it's bad and other times it's sort of mild. John said he would drive me up there the next day. We were up with the chickens and away we went on those rough dirt roads they have there. It's up one hill and down another all the time. Many natives was passed on the road. Where they all were going I had no idea. Some were loaded with quite large bundles on their backs. Many had very large stalks of bananas, I suppose carrying them to some market somewhere. Who bought them I don't know, because everyone there seemed to have lots of banana plants all around their houses (grass huts).

After about a 25 or 30 mile ride we arrived at the border of Burundi and Rwandi. The Burundi guards just waved at us, but when we entered Rwandi about five guards stepped out with their rifles and pistols in the very middle of the road. They make us get out of John's Chevy and led us into the little Border Guard house where we had to answer endless questions as to why we were going into Rwandi and what our business was there. We kept insisting we were going there to visit a friend. They wanted to know who he was and what did we want to see him about. John said we were going to visit Father Florin 9U5BH, and that he was an old friend who we had not seen for a long time. I all of a sudden got a "brilliant" idea. Why not take some pictures of all these guards with me in their midst. We all trouped outside, lined up and took lots of pictures. I explained to them these were color pictures and would have to be sent to the USA to be developed. I think all this picture taking business sort of took their minds off all this questioning. All the radio gear was in those Samsonite suitcases in his car all this time, and I am sure if they had made us "open up" we would never have been allowed to enter Rwandi. It seemed there was two political factions in this country and it was nip and tuck with them. The border guards finally let us thru with us promising to send them some of the pictures when they were developed.

Which reminds me, I never did send those pictures to them. In fact I lost their names and addresses a long time ago. At least my intentions WAS GOOD AT THE TIME!

After passing into the country we started passing different group of people along the

road, dressed as if they were going to a party in their finery, and that "out of this world" hair-do they sport down there. Right down to the top of their head they had shaved a gap about one half to one inch wide and on each side they piled up their hair. Usually one side was a lot higher than the other and some of their hair-do's looked sort of like a hat at a distance. The people we met along the way started waving their hands at us I than noticed when they did this some of them would hold up one finger and others help up three fingers. I asked John what did this mean and found that this signified what party they were for. John suggested that we always wait and let them wave first and whatever fingers they held up that we do the same. John further explained that he had heard of some people in cars who made the wrong gesture and got a rock thru their windshields. Well being an old "hand shaker from way back" this was right up my alley. I became one of the boys from then on. Another few miles and we came upon a very large crowd of people out in a field by the road. A speaker was on a little platform, waving his hands all around and they had a VERY LOUD speaker system blasting away. Sort of "war looking" dances was taking place all over the place. I yelled to John, "stop the car". We stopped and I grabbed my camera to get some shots of all these shennigans, in fact I did actually get a few shots, and the crowd then saw us and we became the center of attraction and their looks was a long ways from being what you would call friendly. John said, "Gus, let's get away from here *right now*, I don't like the looks they are giving us." I agreed with him and he stepped on the gas and away we went like a scared jack rabbit. That was one place I were not overly anxious to hang around. Mind you this was in what I would call "wild country" of mid-Africa. Our intention was to go on to the capital city but when we stopped by to have a short visit with Father Florin and began to inquire about the possibilities of an operating permit and after Father Florin told us how unsettled things were up in the capital, and when he "invited" me to stay with him—I right then and there decided that half a loaf was better than no loaf at all, and I unpacked the gear. I was shown my own private room where all the other Fathers lived, and told the time to be at the eating table for all my meals. Father Florin and

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I headed for the radio shack some few hundreds of feet away with all my gear. I found that Father Florin's knowledge of English was extremely limited. His native tongue was Flemish. We could not do much talking but we most certainly tried, me in English and him in Flemist! That was some "eye ball" QSO, but you know amazingly we somehow did get thru to each other. I still wonder how we did it. I suppose if you wave your hands, yak and yak some more, roll your eyes, wiggle your ears, thump your nose enough you can finally get thru to anyone. Father Florin had quite a big batch of equipment there, all on 15 meter AM phone when I was there and he offered to let me use it. I explained to him that I would rather use my own. He had up a three element beam and nice "V" beam on the USA. We cleared a space on his desk and wired up my gear, Everything was checked out and away I went signing 9U5BH. All my followers were hand, quite a few saying I was a new one for them (which I still doubt!). After 20 went out I tuned up on 40 and it started all over again (I built up a little antenna tuner to use the "V" beam on my 52-ohm pi output gear). I even tried some 80 meters but did not have too much luck with it. The bands stayed open up till about 4:30 AM everynight. I had asked Father Florin about lions around there and he said there were a few now and again. This made my little walk from the radio shack to my room interesting each night at around 4:30 AM. I did actually hear some lions in the distance doing a little roaring, but am glad they were some distance away from where I was. I feel absolutely safe as long as they were some other place. During the daytime you are safe in lion country since they do their roaming around during the nightime. This place where Father Florin stayed was a very large Catholic school with some 2,000 children going to school there, quite a number of them living in the school and the rest in the village. The ages were from 6 years to about 16. I wonder if Father Florin is still there, in fact I wonder if the school is even there with all the "changes" taking place in Africa these days. You know Burundi and Rwandi join the Congo, and Father Florin is from Belgium, and some of these Congolese don't exactly love Belgians. The Congo is very close to where Father Florin's school is located. All of the students there are natives, many different tribes being represented by their different hair makeup, dress and many of them, they say, can hardly even speak to each other. Father Florin has a little "Broadcast Station" there which had a pi output network, which he had connected to the "V" beam, one side of the "V" being grounded. Naturally it would not load up, so I built a tuner for the "V" beam and we were in business with it. Everyone including Father Florin was delighted and so was I. He had a very large assortment of phonograph records and wanted to broadcast a few hours each day for listeners in the village and nearby.

My stay with all the Fathers there was most enjoyable. Radio conditions were very FB and when it came time for me to depart he insisted that I come back by there after I had visited other parts of Africa and spend three or four months with them. Over the air I even got someone to send him a modulation transformer for his "broadcast station". I hope it arrived OK after I left. It would be fine to visit him again and see how he is progressing with his BC station if he is still there.

John drove back from Burundi and picked me and my gear up and away we were off back to his QTH. We drove one night over to Usumburu and visited the head of their Posts and Telegraph asking for permission to use my own call sign instead of John's. We were given his permission to use the call of 9U5ZZ at the QTH of 9U5JH. I only stayed there upon my return for about three or four days using that call sign. One QSO I had from there I well remember. It was a SSB QSO with ZS6ANE in Johannesburg. He asked me if I would like to go down to Bouvet Island? Boy this was for me you can be sure! I was told that it would cost me though and this put a little freight into me and my close budget. I very "meekly" inquired "how much", and was informed that it would be $3.00 per day to pay for my food while on the ship. I was also informed that the ship was going there by way of Tristan da Cunda and Gough Is. This development was something I most certainly had not even thought would turn up. ZS6ANE further told me he had inquired to LA5HE about him going to their authorities to try and get me a license to operate from Bouvet also saying he had already fixed things so that I could use the call sign of ZD9AM from Tristan de Cunha and Gough island. I was told to be sure and be in

Capetown on a certain day, a day that was not too far away. This cut my stay at Burundi. John told me he would drive me to Kigoma in Western Tanganyika, quite some distance from where we stayed in Burundi. With my itinerary all of a sudden tightening up with this deadline to meet the ship in Capetown all my stops between Burundi and there had to be cut to the minimum. The way transportation is in that part of the world you have to allow for delays (oh yes, you will have delays, this you can be sure of). Early the next morning (about 1AM) we were off. I had to get to Kigoma that afternoon or miss the twice-per-week train. Missing this train WOULD PUT ME LATE IN CAPETOWN, and THIS COULD NOT BE ALLOWED TO HAPPEN, and worst of all MISS the trip to BOUVET ISLAND.

Next month: The trip to Capetown.

. . . Gus

Antenna Materials from Sears

If you browse through the Sears catalog, you find many items of interest to the antenna builder. The prices are very reasonable and delivery is as close as your mail box. For ground systems and ground leads, Sears has #8 aluminum ground wire at 50 feet for 95c; and to go with the wire, they offer ⅝ inch copper-clad steel ground rods 6 feet long for 89c. Compare those prices with your local hardware store! In addition, they stock steel antenna masts up to fifty feet, steel guy wire and lightning arresters.

In the Sears Farm Catalog there are even more interesting offerings. For long wire antennas and extensive ground systems, you can buy a half mile spool (2640 feet) of #18 copper-covered steel wire for $9.25; that figures out to about a third of a cent per foot. Be careful about using that #18 in a single strand long wire antenna, better twist two strands together. If you want aluminum wire, they have ¼ mile spools of #13 for $8.95. And—for tower installations, steel fench anchors are available. These little jewels are perfect for anchoring guy wires. Four sizes are available from a small 15 inch job that is rated at 450 pounds to a 48 inch unit that will withstand a ton and a quarter; reasonable too, check and see.

. . . Jim Fisk W1DTY

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(*W2NSD* from *page* 2)

tion for amateur radio in Washington. And they should not suffer confusion over the role played by Bob Booth W3PS, the ARRL counsel in Washington, whose job is to present ARRL petitions to the FCC. Bob cannot, unfortunately, call up a Senator or a Representative and push ham radio for this is prohibited unless he is officially registered to lobby for us . . . and he isn't. Not that Bob could handle any such assignment anyway, for he has a full compliment of other clients and the ARRL is just one of many filling his time with their problems with the FCC.

The other major hobby groups have long since established headquarters in Washington and have strong and enthusiastic voices to protect their interests. I don't have to tell you about the tremendous results the American Rifle Association has had in convincing Congress of their members' points of view.

While there are many areas where the ARRL should be improved, I think that the most valuable long range results for all of us would be the long needed establishment of their Washington Office and the first real representation of amateur radio by the League.

I cannot answer all of the rationalizations that will be brought up against the above in this column. I can forsee a few . . . like maybe "it will be too expensive." Balderdash. Let's not hear cries of poverty while they have a half million or so sitting around in banks and stocks. That money should be out there working for us, not gambled on the market.

Pressure in Washington would not only work to the benefit of amateur radio here in our own country, it should also help to protect us internationally. The basic frequency bands are set by ITU agreement and if we are to hold onto our bands we must have all the support we can get in the ITU . . . and this means first and foremost complete and unequivocal support of our own government. In the last ITU conference in 1959 this was conspicuously absent and only a virtual miracle saved our bands from serious amputation. Are we going into future ITU conferences with the same lack of support? Unless we put pressure on in Washington it is going to be a repeat.

Not that the ARRL couldn't do a lot for us internationally too. In my November editorial I explained about the need for gear in India, which has one of the best possibilities for expansion of ham radio in Asia, held back only by the almost complete lack of equipment. I sent copies of this editorial to the ARRL Directors and asked them to consider the proposal for collecting used ham gear in the U.S. and sending it to India, pointing out that I was well aware that a great many objections could be raised, and that I thought I had adequate answers for any objections or problems forseen. One director said he would do something about it if there was enough pressure from his constituency. One other said he thought the idea unworkable. Huntoon wrote and said that this was old hat . . . the League had considered a lot of stuff like that in the past and decided against it.

One of the biggest problems holding back the expansion of amateur radio in most of the Asian and African countries is the lack of equipment. We can get hold of a 50 kilowatt station easier here than some chaps over there can get a simple transceiver. We have tons upon tons of used gear sitting around in our garages, attics, cellars and in closets that could make a world of difference in a hundred countries. They don't care if it works or not . . . you get the gear to them and they'll get it working. When a transformer burns out in India they don't send for a new one, they take it apart and rewind it.

The ARRL could, if they wanted, spread amateur radio all over the world and spark the operation of thousands of new stations. In every one of the countries I recently visited that has a small ham population I found that there are many eager fellows who stay away from amateur radio because of the gear problem. The ARRL could easily collect equipment through the vast organization they already have set up and which reaches into every corner of our country.

The League history of helping overseas amateurs is a sad one of dropped balls. Their faint attempt in 1962 to work with Rotary International resulted in one single station being sent, I've heard, to a priest in Mexico. In 1963 the League tried to set something up with the Peace Corp, but this, too, came to naught after a couple of unproductive meetings. I gather that the Peace Corps wanted to set up a technical training program and the League held out for pro-

viding complete ham stations or nothing. And that's about it.

There is almost always a way to do something if you really want to do it. I found India most anxious to cooperate in the matter of receiving amateur radio gear and willing even to set aside customs regulations to get it. In other countries I found good possibilities of working through U.S. AID, a section of the State Department. Elsewhere I found the U.S. ambassadors quite interested in helping and there is a good possibility that gear could be furnished through our embassies. And so it goes . . . there are always problems, in anything . . . the successful executive is the one that solves them and achieves the ends in mind. Right now we need amateur radio in as many parts of the world as we can manage.

In addition to helping electronics and communications expand world-wide through our equipment help from the U.S. we will also be putting money in the bank toward foreign support in our frequency allocations of the future. I gather that the main hope at League HQ these days is that the ITU will be so politically strife torn that it will be unable to get together to take away our bands. This is, of course, a possibility . . . but should we bet our whole future on this chance?

By all this I don't mean to be disrespectful of the handbooks and code practice buzzers the League has sent to Liberia and Nigeria (donated by Johnson Company, bless them). This is good and no doubt has been responsible in some degree for the recent increase in amateurs in these countries. But what seems to be needed the most is gear and I don't think we will see any remarkable steps ahead until a program for sending equipment overseas is achieved.

DXCC Changes?

More and more of the DX clubs around the country are calling for an overhauling of the vague and conflicting rules of the DXCC award. The recent decision of the League not to accept the K1IMP/KC4 operation for credit toward DXCC seems to most observers to be nothing more than an attempt to get even with Don Miller for his upsetting of their Honor Roll apple cart.

Let me assure you that there will be no petty political maneuvering with the WTW award. If a station is in a country it counts for that country. There is no question what-

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ever about Herb and Don actually being on Navassa, so the operation is valid for the Worked The World award.

Then there is the matter of a few DX stations that aren't just exactly where they say they are. The ARRL has set a policy of accepting these as counting for the country they claim to be in rather than the one they are actually in . . . and perhaps this is a good solution to the problem. I'd be interested in any good constructive ideas on this subject. I am uninterested in any emotional sanctimonious moralizing. This is something the League will have to eventually face too, for it is getting now to where an adverse decision on this could shuffle some honor rollers from ten to twenty countries.

A few days ago I got a call from K4ZBJ/MM. Seems that Jim is on a ship that spends a good deal of its time going back and forth between Fernando Po and Camaroon. Hmmm, says I, both of those are fairly rare, do you know that MM operation within the territorial limits of those countries counts as a contact with the country for the WTW award? Again, the thinking is that if the station is there, then it should count. This gets away from any political decisions as to who is legal, who isn't, etc. Look for Jim from those countries from now on . . . and any other MM's in unusual territorial waters.

The K1IMP/KC4 decision by the League is insupportable when you consider that they do accept contacts for DXCC with totally unlicensed stations in other countries. For instance, I am willing to gamble that they are accepting contacts with 9N1BG for credit. To my knowledge, and I was there not long ago, this station is unauthorized. This is not to say that there is anything wrong with the station or the operator . . . it happens that no public officials in Nepal have the slightest intention of authorizing amateur radio . . . but have, on the quiet, encouraged amateurs to go ahead and operate, just don't ask for official permission. This same system is used in other countries and should be recognized as a fact of life.

Jim W5PYI (right) and I try noomie hamuph in Baghdad to fight off a chill.

W2NSD/YI

When I mentioned on the air that I was going to be stopping off in Iraq after leaving Syria and Lebanon a lot of fellows wanted to know if I would be getting on the air. I explained that if I could locate a rig in Baghdad I would, otherwise it was the tourist route for me. I did not take any ham gear with me on my trip, figuring that the problems of border crossing were bad enough as it was without being mistaken for a spy or something. I did manage to get on the air from most spots by visiting local ham stations. Nothing turned up in Baghdad, so I spent my time sightseeing.

Jim Cotten W5PYI and I arrived in Baghdad at night. We were a bit unsettled to have the customs officials pull about twenty boxes of cigars out of an arriving man's suitcase right beside us. The chap had forgotten to declare them. I suspect that he is sitting somewhere right now rueing this oversight.

We took a taxi into town with a chap that seemed to know his way around the place. Lucky we did . . . he bargained with the taxi driver for the fare and the trip cost about 50c. Later we found out that taxi fares are generally as high as the drivers can get. And if you make the mistake of taking a taxi on the promise of the driver that you can pay whatever you feel at the end you will have a real keepsake of Baghdad to remember . . .a royal gouging as he asks $20 for the ride and holds out at $10 for the police, etc. The gathering threatening crowds do not encourage you to hold out since he is screaming in their language and no one seems to know yours.

Baghdad is h o t. Our air conditioned room in the Baghdad Hotel was in the 80's and we slept fitfully. Outside it was in the high 90's at night and around 120° or so in the day. Try hiking around in that, fellow tourists.

Actually, other than the heat, we found Baghdad to be a nice place to visit. Unfortunately it was hard to think about anything other than the heat. Orange soda (Gus digs his Coke, I'm an orange fan . . . to each his own) was only about 4c a bottle so I survived

Hank Meyer EP3AM, the American Ambassador to Iran.

staggers through town by frequent orange soda stops. The native beverage didn't look all that good . . . large pans of watered yogurt with a block of ice in the middle. No doubt it is delicious. I may never know.

I did chance the ice cream being made by sidewalk venders though . . . great! And I kept up my sampling of various types of baklava (a pastry soaked in honey) at every opportunity.

The people were very nice to us and many asked if we would like to take their pictures. How different from Africa where the hands come out palms up as soon as a camera comes into sight. You take a picture of a street corner and several people come up menacingly asking for two shillings because you took their picture. Not so in Baghdad . . . they pose and are happy to be of service to you at no charge. I thanked several of them by presenting them with a Polaroid of themselves, but after a few of these the word spread and I found myself almost buried in small kids who wanted their picture taken.

Jim and I took a tour about 60 miles from Baghdad to Babylon and about got our brains fried inspecting the tower of Babel, the summer palace remnants, and other historical trivia.

We had been wondering about the big posters that had suddenly appeared around the city . . . the mobs in front of some government buildings . . . and other puzzlements. We got the word, at last. Seems we were in the middle of a cholera epidemic and didn't know it. All borders to the country had been sealed . . . fifty dead outside of Baghdad, about 15 in the city . . . etc. No one could enter or leave the country unless they had had cholera shots within the last three months . . . and this included just about everyone. Jim and I were about the only ex-

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Remarkable turnout for hamfest in Tehran at EP2GF's shack.

ceptions, having had our shots just two months earlier, so they decided to let us out if the airlines would take us.

Much to our relief we arrived in Tehran the next afternoon via Iranian Airlines. The plane was hours late, but we didn't complain. They sent over a small plane since there was just the two of us for the flight. We breathed a sigh of relief to be away from the cholera epidemic and also to be out of that blast furnace type heat. Tehran was warm, but not unbearably hot.

As soon as I checked into a hotel I called Hank EP3AM, the U.S. Ambassador to Iran, to pay my respects. I'd last talked with him on twenty shortly before leaving New Hampshire. Hank was packing to leave for a vacation the next morning so we made a date to get together that evening for a short QSO. Gerry EP2GF picked me up and took me to see Hank. We had an hour and worked over most aspects of ham radio pretty thoroughly . . . got a couple twenty meter contacts . . . and discussed the future of amateur radio in the mid-east countries.

Gerry said that the EP gang was getting together a couple nights later at his place to meet me. Why not stay at his place instead of that old hotel? OK. Jim said he would rather buzz on ahead to Afghanistan and meet me there a couple days later since he wasn't one of the DX gang anyway.

Gerry lived with a couple other fellows who worked with him at the U.S. armed forces television station in Tehran. Quite a pad too, complete with a pool and cute little Persian girls tittering around. Also one ham station which I promptly put on the air and manned during every spare hour until my departure.

Licenses had been easy to get in Iran up until a few months ago when, suddenly, they

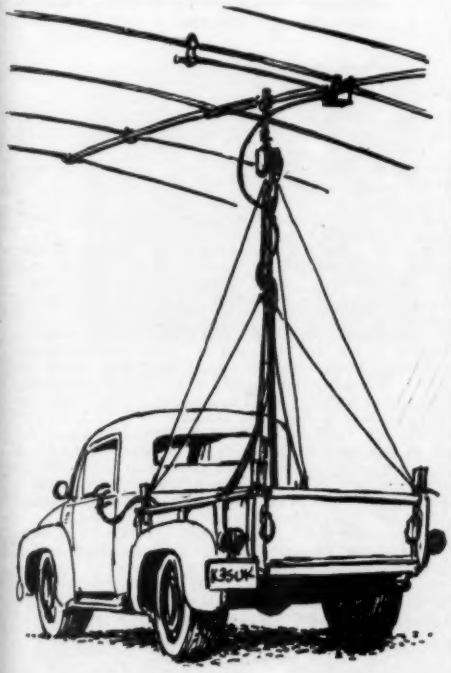
stopped. No one knows just what the problem is or when or even if they will start issuing licenses again. There are a number of locals licensed, which speaks well for the country. Gear is hard to come by, but not impossible. Anyone seriously interested in operating can scrounge up enough to make do.

Although Damascus and Baghdad had some relatively modern parts of town, Tehran was a good deal more modern overall. Gerry took off a day and showed me the sights, including the bazaar, with its hundreds and hundreds of tiny shops strung out along tunnel-like streets. You wouldn't believe all the carpet stores they have there. And Gerry explained that these Persian carpets are more like money than carpets . . . that many of the modern people are buying American carpets when they want carpets.

About thirty of the local amateurs and their wives turned out for Gerry's party and we all had a great rag chew and feed. It was quite a hamfest.

The next morning I was on my way to Kabul and adventure in one of the most interesting countries I visited on my trip.

. . . Wayne



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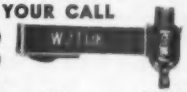

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Letters

Dear 73:

First I would like to tell you that it has been several years since I have picked up a copy of 73. This happened because I more or less was interested in the hobby for a while. At that time I was subscribing to QST, CQ, 73, and VHF AMATEUR. I let all of them run out except QST.

About two months ago I picked up a copy of 73 a friend had down at work. After spending several days almost reading it cover to cover I ordered the following books: Military TV, Index to Surplus, ATV-Anthology, and Parametric Amplifiers. I must say I was very impressed with the quality and material of the books.

For the past couple of weeks now my interest has been steadily building to the point where I have now checked out a 6 meter converter, purchased a used 2 meter converter and pre amp., dusted off the old BC-312, mounted the 6&2 meter beams, and will soon be trying the Heath Kit Seneca to see if it blows up when I turn it on. I also use to work on 432 MHz but that will have to wait for a little while.

I can honestly say that all of this interest has been sparked by reading a couple recent issues of 73. The many technical articles are related to up to date circuits and modern components. There are at least a half dozen circuits I have seen in the October and December issues that I would like to build.

Now the reason I am writing this letter is that I have a rather unusual request. I would like to start another subscription to 73 with the **October 1966 issue.** This is the first issue that I looked at and there are a couple of the circuits in it that I would like to build. I am afraid that I could not get a single copy away from my friend for anything. Trying to find 73s in the second hand book stores around here is a lost cause also.

So if it is not too much trouble would you please start by subscription with the October 1966 issue. If this can not be done then do the next best thing and start with the latest issue.

M. Robert Barnett WA2EWA
Rochester, New York

Dear Mr. Green:

An agreement permitting U.S. amateur radio operators to operate in India was recently concluded with the Government of India. Under the procedures established, an American amateur who wishes to operate in India should apply to do so, preferably before leaving the U.S., by writing to the Wireless Adviser to the Government of India, Department of Communications, Sardar Patel Bhavan, Sardar Square, Parliament Street, New Delhi 1, India. The writer should receive full details by return mail. You might be interested to know that several Americans are already availing themselves of this opportunity and have received licenses to operate amateur radio stations in India.

Donald W. Born, Second Secretary
U. S. Embassy
New Delhi, India

Dear Sirs:

I would like to correspond with a amateur who would like to assist a veterinarian in assembling equipment to monitor the heartbeat of an animal. I want to put a mike jack into the side of a pocket-size two-way radio that can be attached to the harness on the animal, so I can monitor it from my car, which has a receiver in it. I also need a sensitive amplifier to pick up the same on animals inside by clinic. Since I know nothing about building such, I need the expert advice of a ham interested in the field of veterinary medicine. Would appreciate hearing from anyone.

Dr. H. Grady, D.V.M
222 Fletcher Street
Thomasville, Georgia

Dear 73:

Reference is made to Bob Renfro's, WA4NXC, very interesting article in the November issue on the Air Force Eastern Test Range.

Since mention was made to the range prime and sub contractors, PAA and RCA, respectively, let us not forget another range contractor who is instrumental in up-grading the capabilities of the Eastern Test Range.

Federal Electric Corporation (ITT) is presently installing a submarine cable system for the Air Force, between Cape Kennedy and the downrange islands. The new cable will provide up to 270 4kHz channels on which telementry and tracking data, and voice messages, will be sent to the Cape in "real time."

John J. Boucher
WA2LMF
Manager, Quality Control FEC/AFETR
Cocoa Beach, Florida

Dear 73:

I have been involved in ham radio since 1956, under my old call of K9EBC and of late WA9TJT. Operating, exclusively, VHF-UHF because it presents more challenges than any other part of the spectrum.

Today, I have received by first subscription copy of 73. The contents, as compared to other ham magazines, are commendable.

But, gentlemen, this is the beginning of our end. Technical advancements made today and tomorrow will further transport us from technical leaders to meek followers, beginning to learn.

It all started in the days when AM was in vogue. Hamdom decided it needed something bigger, better, and newer. HAIL, the birth of S.S.B. Industry has spent billions in research, redesign, and promotion for us, only to do it all over again for solid state.

We, of simple hamdon, wonder what is in store for us? 1966 has come, departed, and its memory is gone with the countless millions of ham dollars. Now we are blessed with Supercolinears, 2000 watt PEP linears, Solid state ($1500.00) receivers, Single side band, Moonbounce, Scatter, Monolithic circuits, Maser, Laser, etc. In summation I have but three questions: 1) When will ham radio, as we know it today, perish? 2) If it does not perish, whom and of what wealth will it be available to? 3) What shall we write as an Epitaph?

James A. Kohlman, WA9TJT
Chicago, Illinois

Dear 73:

RADIO NEDERLAND, the Dutch World Broadcasting System, has asked me to notify the American Amateur Radio magazines, that they will conduct a Propagation Course in their English language broadcast, starting on the first Thursday in April, 1967.

Presently, the transmitters from which this course will be broadcast, can be heard throughout the entire USA, with excellent signal strength, daily between the hours of 0130 and 0220 GMT, on a frequency of 9.59 MHz. These transmitters ar located on the islands of Bonaire, in the Dutch Antilles, just north of Venezuela.

The course will deal with many problems related to shortwave propagation, among which are:

Ground and Sky Wave propagation	The Sunspot Cycle
The various Ionospheric Layers	Solar Flares and Storms
Single and Muti-hop trajectories	Absorption
Signal strength in relation to radio noise	Fading
Influence of distance, season, and time of day	VHF Propagation

Printed text material and diagrams will be made available, free of charge, to anyone who plans to actively participate in the course. Full details of the wavelengths of the broadcasts and their times, will be sent to those who enroll in the course.

Enrollment is accomplished by writing to:

Propagation Course/
c/o Mr. H. van Gelder
RADIO NEDERLAND, English Section
P. O. Box 222
Hilversum, The Netherlands.

W1ICP Wins WWV Contest

WWV recently moved to Fort Collins, Colorado and sponsored a contest to publicize the move. The first person to report receiving WWV from Colorado was Lew McCoy W1ICP, Novicé editor of QST. Lew called in his report within 30 seconds after the announcement of changeover. Second place went ot William Pearl, WN6UYW, of Los Angeles, and third to Willard Solfermoser, KφDVI, of Fort Collins. Other persons who submitted confirmations will receive their QSL's in a few weeks.

1 AMP SILICON RECTIFIER SALE!

PIV	Sale	PIV	Sale	PIV	Sale
50	5¢	600	19¢	1400	69¢
100	7¢	800	22¢	1600	89¢
200	9¢	1000	40¢	1800	99¢
400	11¢	1200	59¢		

85 WATT NPN
2N1895
25mc ONLY $1.49
Solid State KING

SILICON RECTIFIERS
6000 PIV 200 MA 1.49

ITT 100 AMP RECTIFIERS

PIV	Sale
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100	2.89
200	3.95
400	5.75

New! SILICON CONTROLLED RECTIFIERS

PRV	3 AMP	7 AMP	16 AMP	25 AMP
50	30	48	70	80
100	50	70	1.05	1.20
200	80	1.05	1.30	1.70
300	1.05	1.60	1.90	2.20
400	1.60	2.10	2.30	2.70
500	2.10	2.80	3.00	3.30
600	2.50	3.00	3.30	3.90

'PANCAKE' Transistors 1-Amp
2N2434
3 For $1 TO46
Silicon Planars npn

Watts	VCB*	HFE	mc
.5	80	185	100

SILICON POWER STUD RECTIFIERS

AMPS	Factory Tested 50 PIV	100 PIV	200 PIV
3	7¢	11¢	17¢
15	22¢	40¢	65¢
35	50¢	75¢	1.19

AMPS	400 PIV	600 PIV	800 PIV	1000 PIV
3	22¢	31¢	40¢	59¢
15	90¢	1.35	1.59	1.79
35	1.59	1.90	2.50	2.95

ZENERS
1—WATT..... .45
10 WATTS..... .65

Volts	Volts	Volts	Volts
5.4	18	43	100
6.4	20	47	110
8.0	22	51	120
9.1	24	56	130
10	27	62	150
12	30	68	160
13	33	75	180
15	36	82	200
18	39	91	

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2N424
2N1722
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TERMS: Include postage Rated, net 30 days. CODs 25%

POLY PAKS P.O. BOX 942 A LYNNFIELD, MASS.

New Products

49¢ FET's from Siliconix

Field effect transistors are getting cheaper and cheaper. Siliconix has just announced the E100 series of epoxy-encapsulated N-channel junction FET's for as little as 49c in 1000 quantities. They're excellent for industrial and consumer uses. Full information on the E100, E101, E102 and E103 is available from Siliconix distributors or Siliconix, 1140 West Evelyn Avenue, Sunnyvale, California 94086.

Times Coax Kit

VHF and UHF hams have known for some time that RG-8/U and other common coax is far too lossy for use in stations attempting DX or serious experimentation. However, solid-jacketed, low-loss coaxial cable has been hard to obtain in the past. Now Times Wire and Cable has introduced a kit of 50 feet of ½ inch Alumifoam coax, Timatch connectors, and complete instructions. This kit can easily be installed with no special tools, and provides far lower loss than other coax. You can get more information from Times Wire and Cable, 358 Hall Avenue, Wallingford, Conn.

Sydmur Electronic Ignition

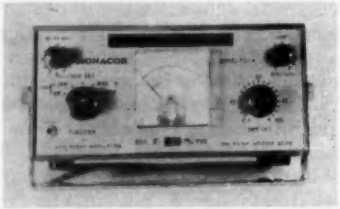
Sydmur has just announced a new transistorized capacitor discharge ignition system that is guaranteed to improve the performance of your car, and save gas, points, tune ups, and reduce ignition noise. It's made for 12 volt, negative ground systems, and sells for $34.75 assembled, or $24.95 in kit form, from Sydmur, Dept. 25H, Midwood Station, Brooklyn, N. Y. 11230.

Grundig Amateur Receiver

Here is a set that should make the XYL very happy: she can use it for FM, AM, SW or airport weather (LW), while the OM can use it for hamming: all-band band-spread, 160 through 10 meters, CW, AM and SSB, battery and AC operated. This is the most all-inclusive receiver we have ever seen, and no feature has been slighted, even a 1000 Hz filter. We kept a couple of SSB skeds with the TR5000 with no trouble, keeping the rf gain control at minimum. There is a connection for external antennas, tape and record input, and tape output jacks; two speakers, one a tweeter; treble and bass tone controls; FM with or without AFC—the reception was quite steady without it; built in whip antenna and ferrite loop (for AM band). The BFO, filter, AVC/MVC switches and the rf gain control are on the rear of the set, out of the way of family use of it so they won't be confused by too many knobs. The CW stability of this set is excellent—better than some ham sets we have heard, and this, of course, contributes to effective SSB reception. The tone of the audio is excellent, and is one of the reasons we think this will be a mighty popular family rig. This gem is being sold by Radio Products Sales, Inc. of 1501 South Hill Street, Los Angeles, California, 90015. . . . K1RA

17th Edition Radio Handbook

The 17th Edition of the popular Editors and Engineers Radio Handbook by Bill Orr, W6SAI, is now available. This new handbook is the latest version of one of the standards of ham radio, and contains not only the many pages of design information and reference material that all hams need, but also many new construction projects. All of the information is up to date and useful. The 17th Edition features expanded chapters on SSB gear and semiconductors. The cover is an attractive stain-resistant white, and the book is 832 pages long. Copies are available for $12.95 from your local radio distributor or from Editors and Engineers, P.O. Box 68003, New Augusta, Indiana 46268.



The Monarch FSI-4 SWR Bridge, Modulation Meter, Power Meter and TVI Filter

This new instrument from Monarch Electronics should find a place in the shack of many hams, both old and new. Although limited to 250 watts or so, the FSI-4 is a compact unit that includes an SWR meter, modulation meter, power meter and TVI filter all in one neat package. The power limitation of 250 watts is due mainly to the components used in the TVI filter; with a cutoff frequency of 55 MHz, the components used in the filter limit the maximum power input to 250 watts up to 52 MHz. It is also usable on two meters with less than 1 dB loss, but the power input on this band must not exceed 50 watts. An additional feature of the FSI-4 is the built-in on the air indicator; this circuit is driven by an external 6.3 volt source so no power is derived from the transmitter. If you're interested in a unit that is good looking and provides several varied but important functions in the same package, write to the people at Monarch; they'll be happy to provide full specifications and tell you where you can buy it.

. . . Jim Fisk W1DTY

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AC POWER SUPPLY f/BC-603: Wired $14.95. Kit $10.00
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PRV	7A	20A
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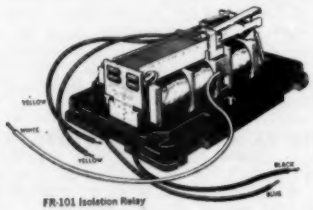
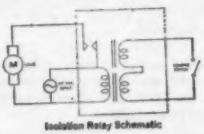


FR-101 Isolation Relay



Isolation Relay Schematic

Alco Isolation Relay

An interesting new device from Alco is an isolation relay, a combination 110 volt ac transformer and relay on a common core. It is controlled by low voltage, safe ac, yet can handle 5 amps at 110 V. Among the uses for the relay given in the instruction booklet that comes with it for $3.85 are various remote controls, soldering iron tip saver, fire alarms, rain and burglar alarms, PTT switches, and many more. Alco Electronic Products, Lawrence, Mass. 01843.

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WE WILL PAY CASH: Wanted, popular, late model unmodified amateur equipment. Highest prices paid for clean good operating gear. Write Graham Radio, Dept. 103, Reading, Massachusetts.

ARE YOU SINCERE? Are you really looking for the best deal on a new or fully guaranteed used unit? Let us convince you with a specific quote that will really save you money. Graham Radio, Dept. 10, Reading, Massachusetts.

MOTOROLA new miniature seven tube 455 kc if amplifier discriminator with circuit diagram. Complete at $2.50 each plus postage 50c each unit. R and R Electronics, 1953 South Yellowsprings, Springfield, Ohio.

COMPLETE CONVERSION instructions for the AN/VRC-2, just $1 while the supply lasts. 73 Magazine, Peterborough, N. H. 03458.

1963 BOUND VOLUMES OF 73. $15 each from 73, Peterborough, N.H. 03458.

ROCHESTER, N. Y. is headquarters for Western New York Hamfest and East Coast Spring VHF Conference, Saturday, May 13. Top programming plus huge "flea" market. For more information, write: Rochester Amateur Radio Assn., P.O. Box 1388, Rochester, N.Y. 14603.

FREE CATALOG—loads of electronic bargains. R. W. Electronics, Inc., 2244 So. Michigan Avenue, Chicago, Illinois 60616.

DAYTON HAMVENTION April 15, 1967—Dayton Amateur Radio Association's 16th annual Hamvention. Wampler Arena Center, Dayton, Ohio. Participate in the technical sessions, forums, banquet and hidden transmitter hunt. Bring XYL for best in women's activities. For information write Dayton Hamvention, Department C. Box 44, Dayton, Ohio 45401.

RTTY GEAR FOR SALE. List issued monthly. 88 or 44 mH toroids five for $1.75 postpaid. Elliot Buchanan, W6VPC, 1067 Mandana Blvd., Oakland, California 94610.

ESTATE SALE and bargain list. Send for it and include SASE. Write Paradd Sales and Engineering Service, 280 Route 10, Dover, N.J. 07801.

PLASTIC HOLDERS—each display 20 QSL cards. 3 for $1.00 or 10 for $3.00 prepaid and guaranteed. Free brochure of other ham goodies included. Tepabco, Box 198N, Gallatin, Tennessee 37066.

50 FOOT MAST DESIGN. Designed for commercially available materials. Why pay $360 for a 50 foot tower? Send $1. Joe Shaw, 2014 Boston, Irving, Texas.

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NOVICE CRYSTALS, all bands, $1.30 each. Also other freqs. Free list. Dealer and club inquiries invited. Nat Stinnette, Umatilla, Fla. 32784.

UNIQUE relay to build variety of remote controls, model railroads, liquid level control, weather detector, burglar alarm, games, trick circuits. 20 design ideas included free. 3.95 prepaid. Dept. E., Alco, Lawrence, Mass.

COAXIAL CONNECTORS. Similar to old Gen'l Radio type 774. Set consists of CBWU 49121-A plug, CANS 62112 cable adapter and CN 49120 jack. If you have any of the older model G-R test equipment, these are the connectors you need. $1.25 each in lots of 10. Large qty avail; dealer inquiries invited. K. Y. Hoo, 3233 Conti St., New Orleans, La. 70119.

WANTED: Copies of 6-UP Magazine. Numbers 5, 6, 7 and 8 to complete personal collection. Also copies of VHFER for 1963 and 1964; April 1965 also needed. W1DTY, RFD 1, Box 138, Rindge, N.H. 03461.

TEN METER SIGNAL GENERATORS, $5.95 each. Postpaid. Crystal controlled tone modulated. On PC board. 2 x 5 inches. Like new. Tested. Your choice in 10 kHz steps. 28.615 to 28.905 MHz. Less battery and switch. Specify frequency. Sorry, no COD. Wayne Lafayette, 5429 North Detroit St., Toledo, Ohio 43612.

WANTED—Teletype 28s, parts, what have you. SELL—machines, parts. Fred Schmidt, W4NYF, 405 NW 30th Ter., Ft. Lauderdale, Fla. 33311. 305-583-1340 (9 P.M. EST.)

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WANTED: Heath HW-32. Cheap for cash. Must be good condition. J. M. Fraser, Box 95, Binscarth, Manitoa, Canada.

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DRAKE 2A RECEIVER with 2AQ Q-multiplier and 2AC crystal calibrator, excellent condition, $180. Heath DX-20 xmtr in good condition, $20. Certified check FOB, Dick Scholl, WA8QYE, Maple Grove Rd., Lancaster, Ohio 43130.

CHRISTIAN HAM FELLOWSHIP now being organized for Christian fellowship and for gospel tract efforts among hams. Christian Ham Callbook $1 donation. Free details on request from Christian Ham Fellowship, P.O. Box 218, Holland, Michigan 49423.

FOR SALE CHEAP: Eico 753 transceiver and 751 AC power supply. Excellent condition. Not a scratch. Jim Coulter, K8HKQ, 191 Union St., Hillsdale, Michigan.

HQ145XC rec., S200 speaker, Seneca 6 and 2 transmitter, Johnson 6 and 2 converter. $365. WA0ILV, Frank Miller, Clarkson, Nebr. 68629.

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TOROIDS-DIODES-COAX CONNECTORS: 88 mH toroids, 45¢ each, 5/$2. 1000 PIV, 1 amp top-hat diodes, 55¢ each, 2/$1. Connectors: PL259, SO239, M359, 45¢ each, 10/$4. Button feedthroughs (while they last) 500 pF, 500 V 20/$1. Add sufficient postage. R and R Electronics, 1953 S. Yellowsprings Street, Springfield, Ohio.

VARIACS: General Radio and Ohmite. 60 cycles, input 120 V output 0-280 V at 1 amp or input 240 V, output 0-280 V at 2 amp. Pullouts in guaranteed excellent condition. $6.95 plus postage. Shipping weight 10 lbs. R and R Electronics, 1953 S. Yellowsprings Street, Springfield, Ohio.

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WANTED: Tuning Units for R5007A/FRR502M receiver. Quote price, frequency and condition. W. E. Wolff, K5JPA, 108 Nichols St., San Marcos, Texas 78666.

MODEL, 14 typing reperforator; TD; HE-45a, matching VFO; HW-12, Hustler antenna. Best offer. Must sell to finance spring semester. K1OQQ, Union College 634, Schenectady, N.Y.

HANDBOOK OF HAM RADIO CIRCUITS by W9CGA. Complete schematics and operation data on many popular ham receivers, transmitters, transceivers and power amplifiers. $2.95 from 73 Magazine, Peterborough, N.H. 03458.

CONVERTERS, three transistor, 50-54 m in, 14-18 mc out, wired, tested, printed circuit. Crystal controlled, $10 ppd. Tuneable, $8 ppd. Syntelex, 39 Lucille, Dumont, N.J. 07628.

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WANTED: Tubes, transistors, lab instruments, test equipment, panel meters, military & commercial communication equipment and parts. Bernard Goldstein, Box 257 Canal Station, New York, N.Y. 10013.

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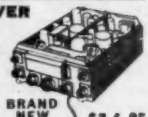

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75S-3B, 3 filters $450. 75S-3C, 3 filters $550 (extra crystals). 32S-3 with AC power supply $575. 312B4 $110. 30S-1 extra final and other tubes $650. New 4CX1000 tubes $30 each. Send certified check to Clinton Pierce, 6136 Manton Aenue, Woodland Hills, Calif. Phone 346-7908.

HAMFEST: Belgium, Wisc. April 1st. Prizes, entertainment, swap shop, etc. Advance tickets $4 including dinner. P.O. Box 13, Port Washington, Wisc.

KISHWAUKEE RADIO CLUB hamfest. Hopkins Park Shelter House in DeKalb, Illinois on Sunday, May 7. Contact WA9MBJ for more information.

HALLICRAFTERS SX-110 receiver, perfect condition, general coverage with ham bandspread, crystal filter $90. Local only. Pullman, 758 Brady, N.Y.C. 597-6293.

I'D RATHER SELL extra equipment than see it collect dust. Late National NCX-3, NCX-A, $225. Mint Drake 2B, 2BQ, 2AC, $229. Unassembled Eico 720 transmitter kit, $49. Edward Pacyna Jr., 36 Nahant Ave., Dorchester, Mass. 02122.

VOTE! VOTE! VOTE! HAMS! National incentive licensing poll! Vote for or against, signing your call and handle on QSL or postcard. Now! Results petitioned to FCC. Spread the word fast. Vote today. Rush your vote to SCCARC, Dept. 73, Box 685, Moravia, N.Y. 13118.

HELP K9LUF celebrate one year as a General on April 1st and 2nd and get a special certificate. 21.350 and 14.250.

WANTED: TEST EQUIPMENT, laboratory quality such as Hewlett-Packard, General Radio, Tektronix, etc. Electronicraft, Box 13, Binghamton, N.Y. 13902. Phone 607-724-5785.

BEAUTIFUL SB-300 $210 and SB-400 $280 or combination for $450. WA1CTL, 16 Woodside Drive, Wilbraham, Mass.

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BIRMINGHAMFEST: April 29 and 30. Write Box 603, Birmingham, Alabama.

COAXIAL transmit-receive relays rated 400w, auxiliary contacts for receiver mute, etc. SO-239 connectors, $7.00 postpaid. Randy Beamer, 645 57 Ave. N.E., Minneapolis, Minn.

SELL: Millen KW Transmatch 62200 $100.00, Millen Modulation Monitor Scope 90932 $50.00, connects to transmatch. Both for $140.00. WA9OBR, Rev. Elwood Anderson, Manlius, Illinois.

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THE ROCKAWAY AMATEUR RADIO CLUB Spring Auction will be held Friday evening, April 14th, at 8:00 P. M. at the American Irish Hall, Beach Channel Drive (at Beach 81st St.) Rockaway Beach. Come to the best auction in the New York area. For detailed directions write to P.O. Box 205, Rockaway Park, N.Y. 11694.

GRAND RAPIDS AMATEUR RADIO ASSOCIATION presents their 19th annual Amateur Radio Convention Friday and Saturday, April 21-22, in the Civic Auditorium, Pantlind Hotel, Grand Rapids, Michigan. Write: G. R. A. R. A., Box 1333, Grand Rapids, Michigan 49501.

OHIO All day Saturday, April 29, the Indian Hills Radio Club will host Greater Cleveland Radio Hams and friends at the Alliance of Poles Hall, 6968 Broadway Ave. (Near Fleet and Rt. 21, Willow Freeway). This large hall will allow an all-indoor affair with ample space to sit and renew contacts with Cleveland Area Hams. Several meeting areas are available. Old fashioned good-will and sociability is the theme of the day. Donations at the door are $1.00 and tickets to an inexpensive buffet dinner at 7:00 P.M. $2.00. Contact John Williams K8SEV, 13231 Shaw Ave., Cleveland, Ohio 44112.

GONSET GSB-100 Exciter, good condition, no scratches. Looks new. $180.00 will ship. Wm. R. Hirt, W7GBJ, 1019 S.E. Roberts, Roseburg, Oregon 97470.

KANSAS: THE JAYHAWK AMATEUR RADIO SOCIETY announces a Hamfest and joint ARRL section Meeting to be held April 23, 1967 at Wyandotte County Park, just East of Ag. Hall of Fame, Bonner Springs, Kansas. Free hot dogs, chips, and drinks, gifts for ladies and amateurs. Registration $1.50. Auction, swap table, YL tour, cooking demonstration, fashion show, DX, equipment displays, closed circuit TV, novice attractions, and more. Talk in 3920, 50.14 and 146.94. For more info contact K0BXF, 3045 North 72nd, Kansas City, Kansas 66109. CY 9-1128.

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12	.25	.50	.75	1.00
18	.20	.30	.75	1.00
45	.80	1.20	1.40	1.90
100	1.60	2.90	3.50	4.60
240	3.75	4.75	7.75	10.45

D. C. Amps	400Piv 280Rms	600Piv 420Rms	700Piv 490Rms	900Piv 630Rms
3	.40	.50	.60	.85
12	1.20	1.50	1.75	2.50
18	1.50	Query	Query	Query
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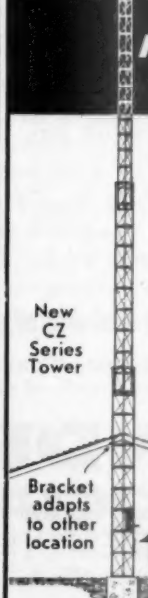

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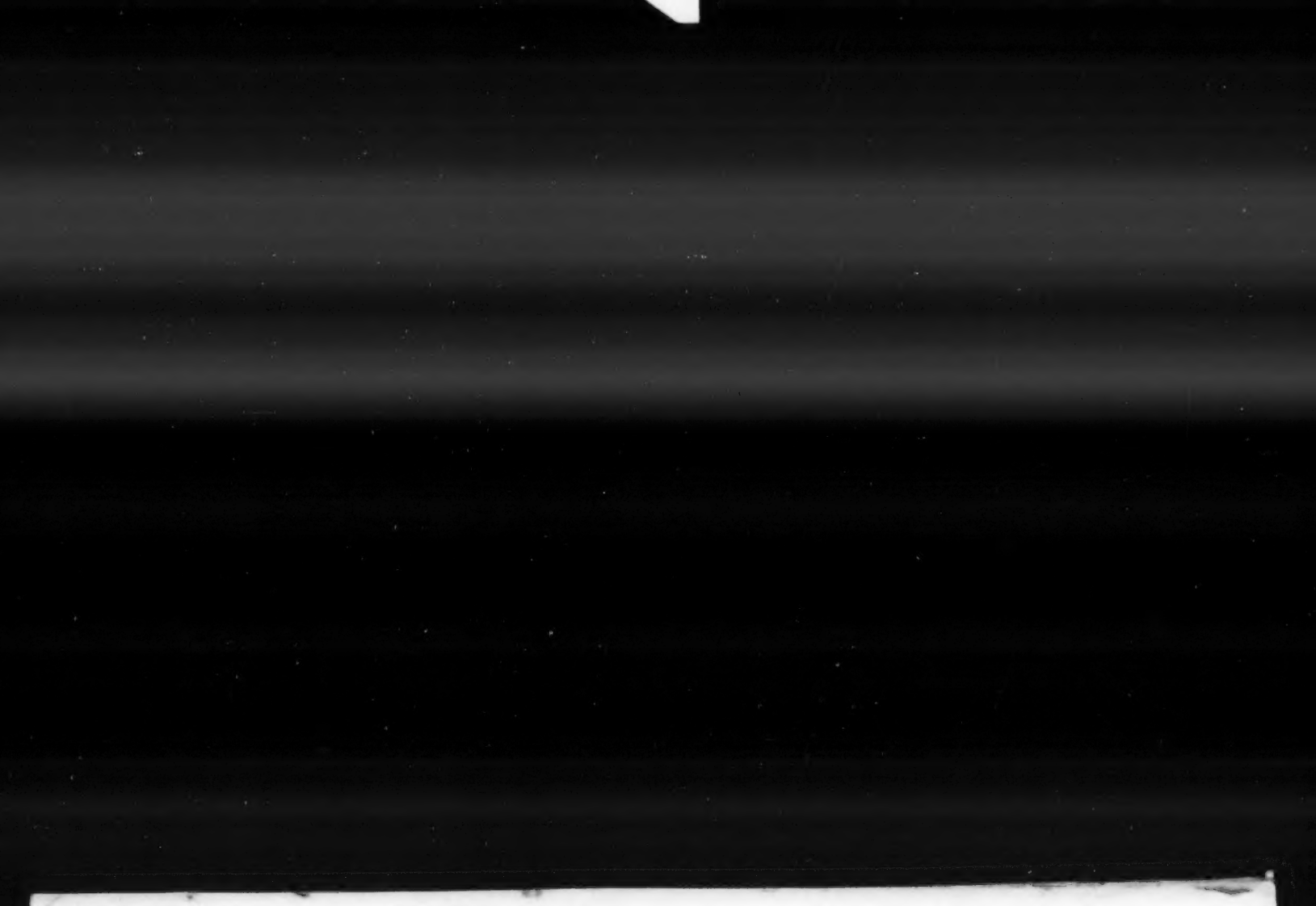
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